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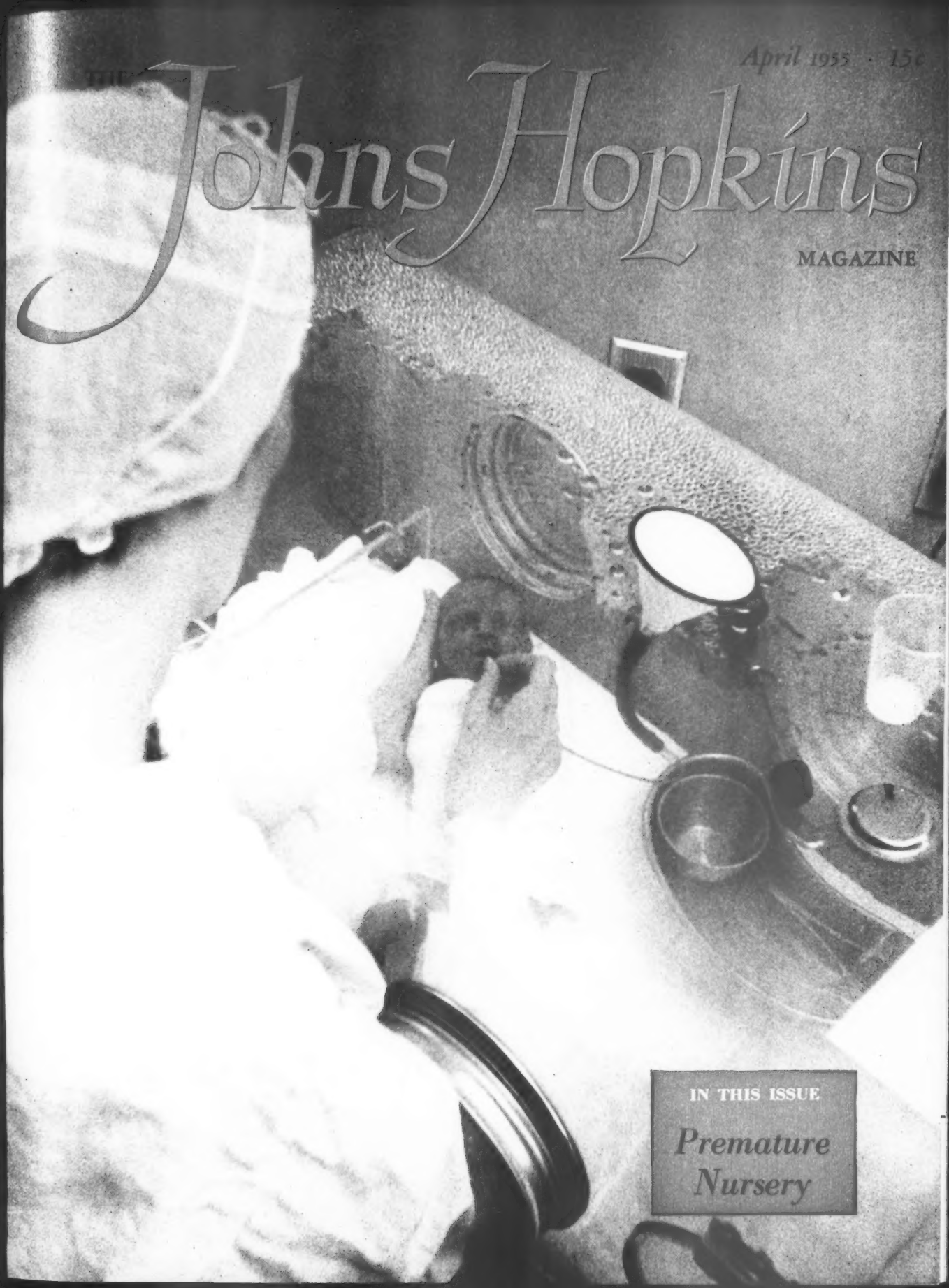
THE Johns Hopkins MAGAZINE



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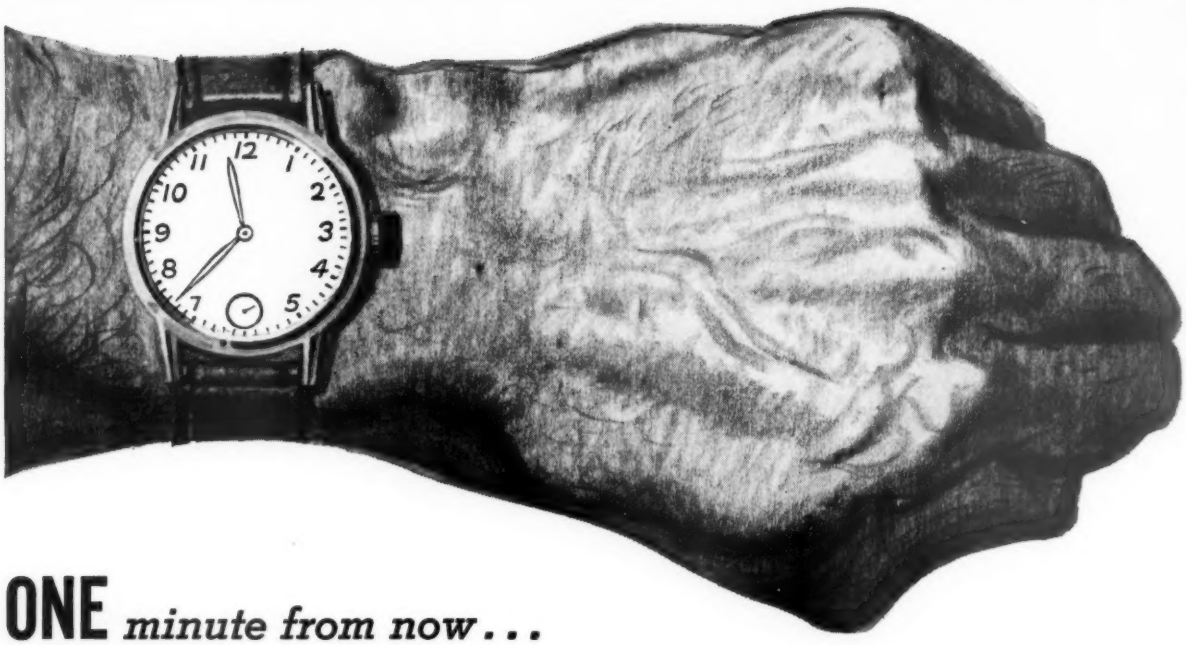
Premature Nursery



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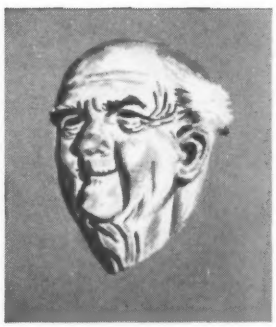

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THE COVER

In an incubator in the premature nursery of the Johns Hopkins Hospital, a tiny infant is aided in its fight for life. The nurse reaches the baby by using portholes in the side of the incubator. They have an ingenious entrance that keeps the incubator sealed at all times. A picture story of the care that premature babies receive begins on page 12, this issue.

PHOTOGRAPH BY WERNER WOLFF

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EDITORS' NOTES

Why should the coming of springtime seem so remarkable each year? There it is, plainly marked on the calendar; there it was on a chilly day last winter, when the calendar was put into service. It was buried beneath seventy or eighty pages of dates, to be sure, but its rise to the top of the pad was inevitable. So why the wonderment, the feeling that one is in the presence of a miracle, when it arrives?

But the wonderment is there, and a wonderful wonderment it is, when you experience it. We have always thought it would be fine to prolong the experience; to fall in step with the march of spring in the South and follow it as it moves across the land.

This year, through the coincidence of an involved series of travels, we had the opportunity to do so for the first time. We first encountered spring in Texas, where people looked at us strangely when we debarked from a plane bundled in overcoat, hat, and muffler. We lost it in Baltimore, where we returned to find snow on the ground. We found it again in Italy, when we traveled from a wet blizzard in Milan into a warm, sunny day in Venice which brought out the whole town for spring's first promenade. We lost it in ten days of rain and snow in Bologna, and in a few hours' trainride we found it again in Rome, where there were violets and blossoms and people singing in the streets.

And now, in Baltimore, our paths have crossed again. A woodpecker is making a racket not far from our office; perhaps woodpeckers do this at all times of the year, but today our windows have been pried open, we can hear the sound, and whatever the ornithologists say it means spring to *us*.

The papers still carry reports on snow conditions in the skiing resorts to the north, so with luck (since we must make a swing into New England) we can overtake spring once more. That will be fine with us; we're not sated yet.

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Wanted: Hot-Climate Cattle

This pure red Sindhi bull, taking daily exercise, is one of the animals used in experimental studies of heat tolerance conducted at Beltsville.

Photographs for The Johns Hopkins Magazine by Werner Wolff, Black Star

MAN is a tropical being, but this cannot be said for most of his domestic animals. Nearly all of them suffer in hot weather and become inefficient. The more man asks of them in the way of milk, meat, eggs, or wool, the more they are affected by the heat.

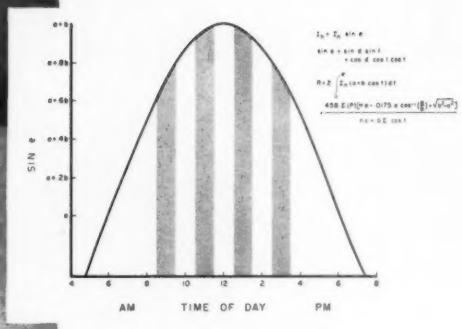
Yet some animals suffer more than others. The humped cattle of India are generally more tolerant than European breeds. Merino sheep thrive in hot, dry semi-deserts. White Leghorn hens survive when other breeds die from heat.

Why is one animal better able to stand heat than another? And how can high tolerance to heat be combined, in one animal, with high productivity? If scientists knew what it is that makes animals heat-tolerant, they might be able to build up heat-resistant herds relatively quickly and inexpensively.

The Dairy Husbandry Research Branch of the U. S. Department of Agriculture at Beltsville, Maryland, is studying these problems in relation to dairy cattle, in collaboration with Douglas H. K. Lee, professor of physiological climatology at Johns Hopkins. At the end of the war, the Agriculture Department imported some Red Sindhis, an important breed of humped Indian or "zebu" cattle. They have been crossed with Jerseys and Holsteins in such a way that all combinations by eighths, from pure Sindhi to pure Jersey or Holstein, are now available.

Each animal is given a heat test every two months throughout its life. Careful records are kept of its milk production. Special experiments are designed to see whether good heat tolerance is due to such factors as active respiration (an important cooling device for

◀ Attendant at Department of Agriculture's Dairy Husbandry Branch holds animal in place while respiratory volume is measured.



With pyrheliometer, scientists can measure intensity of solar radiation. Radiation chart indicates the basic relationship used in such estimates.

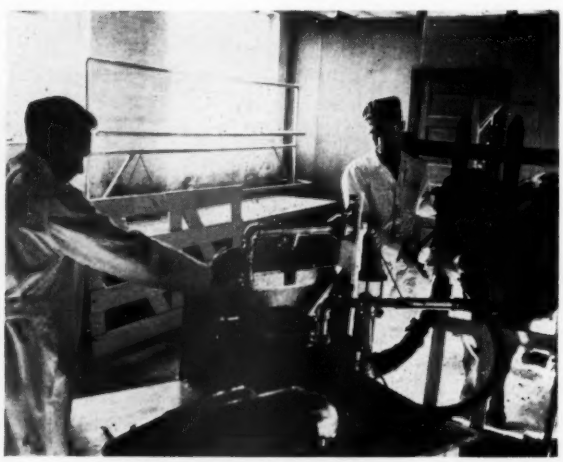
HOT-CLIMATE CATTLE

Continued

most animals), evaporation of water from the skin, thinness of coat, extent of skin surface, or efficient utilization of food.

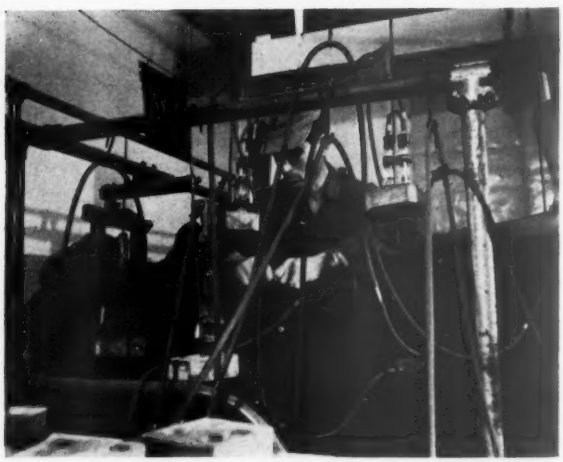
The scientists are also studying the effect of weather conditions upon milk production and other aspects of animal behavior. Animals kept in Louisiana are compared with those at Beltsville. Records are kept of the conditions to which the animals are exposed, such as the incidence of solar radiation, temperature, humidity, and air movement.

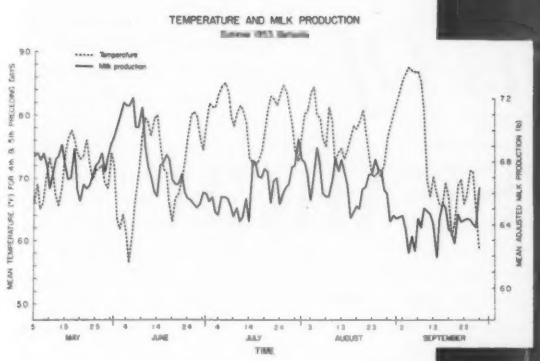
PROGRESS with slow-breeding cows cannot be rapid. But important suggestions are emerging. Heat tolerance is probably due to more efficient food utilization rather than to better body cooling. A one-half Sindhi,



Normal reactions are recorded before animal is exposed to heat. Dr. Lee is measuring skin temperatures while attendants gauge respiratory volume.

The rate of evaporation from representative areas of skin is measured by circulating air through capsules which are cemented to the skin and to an absorber.



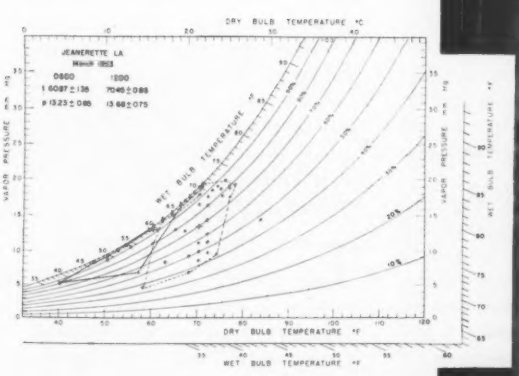


Study of milk production and weather conditions during summer months shows that production is affected by conditions four and five days before milking.

one-half Jersey mixture tends to give the best combination of milk production and heat tolerance. A hot day drops a cow's milk production four to five days later. Holstein cattle kept in the barn in Maryland begin to be affected by heat when the mean temperature for two days exceeds seventy-one degrees Fahrenheit. Sindhi-Jersey crosses adapt to Louisiana conditions but Jerseys do not.

Graduate students in the biological sciences at Johns Hopkins join in these studies and use the facilities for parallel research on other animals. Robert McDowell, who is in charge of the work for the Department of Agriculture, participates in their instruction. The Food and Agriculture Organization of the United Nations strongly encourages such attempts to increase animal production in the less-developed tropical regions and frequently calls upon Dr. Lee and his associates to assist in promoting this work.

For if continued progress can be made, the results for many areas of the world may be truly revolutionary.



Total weight loss during exposure in hot room is measured by scale. Psychrometric chart reveals range of climatic conditions over a month's time.

Some Implications Of SCIENTIFIC RESEARCH

By RALPH E. GIBSON

We live in an age which is an age of luxuriant science, of rapidly expanding and continually changing technology. Intense economic and military competition renders it imperative that potential advances in the useful arts and industries be exploited with the minimum of delay and translated into products for the markets or the arsenals of the world.

The enormous acceleration in technological progress, and the increase in the number and variety of materials and commodities it provides for the enrichment of life, stems from scientific research and its products, systematized knowledge and understanding—or, as we commonly call them, *science* or *natural philosophy*. Indeed, the prosecution of scientific research for the material benefit it brings has become big business; an increasing number of men and women are following it as a profession and vast sums of money are channeled into it. Last year, the estimated annual budget of the United States alone for research and development exceeded two billion dollars.

This is all the more remarkable when we consider that scientific research is really one of the younger intellectual activities of mankind, having been practiced in its present form for little more than three hundred years. The application of scientific research to the useful arts and industries is even younger, being barely one hundred years old.

Science itself is growing and spreading into all phases of human activity with such explosive rapidity that it is almost meaningless to speak of science as if, at any given time, it had a definable value or even a bounded identity. Hence, I have used the term "scientific research" rather than "science" in the title of this article, for I think that, in an era of rapid expansion, the means of developing new knowledge is a somewhat more stable quantity than the product. We may regard the term "scientific research" as a measure in some way of the time rate of change of science which, even though it changes less rapidly than its products, is nevertheless by no means a stationary quantity.

I want to make this dynamic implication of scientific research clear from the outset. In discussions of Science (with a capital "S"), it is all too frequently overlooked, with unfortunate results. For example, I read recently this statement of an eminent scientist: "Among the failures, one must also include science. In fact, its failure to realize and fulfill its social function is probably the most unfortunate of them all." The statement is comparable to charging an adolescent with failure because he has not the wisdom and achievements of a man of forty.

Fifty years ago, chemistry was considered to be a fairly well advanced science, but it had little to contribute to the understanding of the functions of the human body or the cure of disease, even though the subject had been of interest to many chemists for decades. Had chemistry failed? I hardly think so; it had not grown up enough. A continuation of research in the fundamentals of chemistry and biochemistry, following lines established even fifty years ago, has changed this situation to a point where medical men are turning more and more to chemistry for an understanding of their problems and for materials to alleviate or cure human ills.

In 1890 it was affirmed dogmatically, on the "authority of science," that atoms were indivisible. "Science had failed to split the atom." Yet researches then under way led inevitably to techniques for dividing atoms and liberating incredible stores of energy in the process. In sixty-odd years, the position is so changed that this same "indivisible atom" and its energy are the source of major political turmoil in the world, and a distinguished alumnus of this University is now adviser to one of the largest banks in this country on the economics of atomic energy.

We could multiply examples but I hardly think it is necessary. Suffice to say that in the mid-twentieth century, research, the rate of growth of systematic knowledge, is itself growing rapidly, and we who stand as a link between the past and future on this rapidly curving path are shocked by our own presumptuousness when we try to predict the world of tomorrow from a knowledge of the world of yesterday.

This growth of science, and the measure of support it now commands, stems from the spectacular contributions it has made through technology to our material welfare, comfort, and security. The enriching effect of these applications on our material civilization is unquestionable. And a continued extension of the role of science in technology

is essential if we are to preserve the way of life which we have learned to enjoy so much that we and the generations to come will do our utmost to maintain and to extend it.

However, scientific research started as an intellectual pursuit, and it still offers to mankind benefits that transcend purely materialistic considerations. Herein lie its links with other aesthetic and intellectual phases of life, such as art and philosophy. Herein also lie its discipline and methods, whose value in cultivating discrimination and judgment constitutes one of the strong educational assets of our time. It is the implications of these aspects of scientific research that I propose to discuss.

In order to develop a background we must inquire more closely into the meaning and methods of scientific research itself. I would remind you that we are dealing with a human activity devised and prosecuted by men. It is, therefore, complicated by entanglements with other human activities and subject to the tyranny of words. There is, however, something unique in science, something which was introduced over three hundred years ago by Galileo, Newton, Bacon, Descartes, and their contemporaries, something which differentiates the natural philosophy of today from the natural philosophy of the Greeks, for instance. We shall try to define this "something."

THE starting point of scientific research, a quest for understanding inspired by curiosity, was well expressed by Francis Bacon, Viscount of St. Albans:

"Men, on their side, must force themselves for a while to lay their notions by and begin to familiarize themselves with facts."

The establishment of facts is a most important and laborious aspect of scientific research. It must be approached with extreme objectivity and even skepticism. It requires that the investigator take nothing for granted, least of all the evidence of his own unaided senses. These must be disciplined and fortified with instruments. Not only must the observations leading to facts be carefully made, but the conditions under which the observations are made must be controlled and defined with extreme care. Finally, human authority, tradition, or prejudice must be eliminated from consideration by the investigator who wishes to establish a new fact.

However, no matter how careful a worker may be in controlling his experiments and refining his observations, he must be provided with a criterion of general acceptance against which to check the validity of a fact. In scientific research, this criterion is provided by *reproducibility*; a fact or experience is valid when it is independent of the observer, when it can be reproduced by anyone who takes the trouble to repeat the observation or experiment under the proper conditions.

Now this criterion of reproducibility has far-reaching consequences. It requires that the observer of the new fact describe the conditions and results of his observations in such a way that any other experimenter can perform exactly the same experiment and obtain exactly the same result. Results are valid scientifically only when they can be communicated to any serious and intelligent listener in such a way as to convey to him a meaning exactly that intended by the author, a quantitative description of experience which that listener can independently verify. This generally means that the results must be quantitative and expressible in exact terms; nowadays this means mathematical terms.

HOWEVER, as C. N. Hinshelwood, of Oxford, reminds us, "science is not the mere collection of facts, which are infinitely numerous and mostly uninteresting, but the attempt of the human mind to order these facts into satisfying patterns. . . . The imposition of design on nature is in fact an act of artistic creation on the part of the man of science, though it is subject to a discipline more exacting than that of poetry or painting."

The objectives of scientific research must be broadened, therefore, to include not only the exploration of natural phenomena, the isolation of communicable facts, the confirmation of facts by the criterion of reproducibility, but also the construction of patterns into which valid facts may be fitted with satisfying consistency. The simpler the pattern and the more facts it accommodates, the more satisfying does it become. The word "satisfying" is repeated here because it properly has an aesthetic connotation. It must be emphasized, however, the patterns of which we speak must, like the facts themselves, be communicable unambiguously from one worker to another. The great contribution of Newton was not the observation that apples fall, but the fitting of this fact quantitatively into the same pattern that describes the motion of the planets in their orbits and the expression of this pattern by a general formula that conveyed an exact meaning.

AT the risk of seeming extreme, I shall classify as only by-products of scientific research items of such great importance as new machines, new instruments, and new substances, materials, drugs, etc. —new techniques, the discovery of new species, even the creation of new sciences or industries. This will emphasize that the unique and characteristic objective of scientific research is the systematization of valid human experience in satisfying patterns that can be expressed quantitatively and exactly.

This attempt to fit valid experiences or "facts" into satisfying patterns with the help of the cohesive bond of a system of logic is important from three points of view. In the first place, it facilitates comprehension. An estab-

What makes research scientific? What are its goals? What kinds of mind are needed for success? Here are some suggestions by the director of the Hopkins Applied Physics Laboratory

SOME IMPLICATIONS OF SCIENTIFIC RESEARCH

Continued

lished pattern is an excellent aid to memory; we carry around a great deal of knowledge merely by remembering the pattern and not overburdening ourselves with isolated facts. This increases the power of the human mind to comprehend its cumulative experience; I need hardly remind you that such a pattern is exemplified by the laws of thermodynamics and the theory that makes possible rigorous deduction from them. This pattern embraces a large fraction of the experience of chemistry and engineering.

In the second place, a pattern gives us a basis for understanding by bringing out relationships among isolated facts or events. We understand new experiences when we can express them in terms of experiences already familiar to us.

In the third place a satisfying pattern always suggests extensions of itself and, thereby, gives a sound and fertile foundation for the prediction of new facts or events. In short, a satisfying pattern (or theory) enables us to mobilize knowledge for immediate use, not only in the domain of pure science but also in the domain of applied science.

We may illustrate certain interactions which characterize the general *modus operandi* of scientific research by the use of feedback loops or circuits, ideas borrowed from the technical fields of electronics or automatic control. Such a scheme is illustrated in the chart on the opposite page.

The upper three white boxes are linked in a circuit representing what Claude Bernard has called the "interplay of experimental theory and experimental practice." From observation and careful study of phenomena or events, facts are obtained which may then be fitted together in an experimental pattern (law or generalization). If the facts fit well into a pattern, the latter immediately suggests new subjects for observation or new experiments from which come new facts. And so the activity in the circuit builds up and with it, confidence in the validity of the facts and the consistency of the theory. On the other hand, if the facts do not fit into a recognized pattern, one must first make a further study of their validity to insure that they have not been vitiated by some error; and errors may arise in very subtle ways. At the same time, it may be necessary to reexamine the pattern or theory and, if need be, modify it to accommodate the new facts. The process is a cyclic one and only when the facts and the theory fit together can we be content with either.

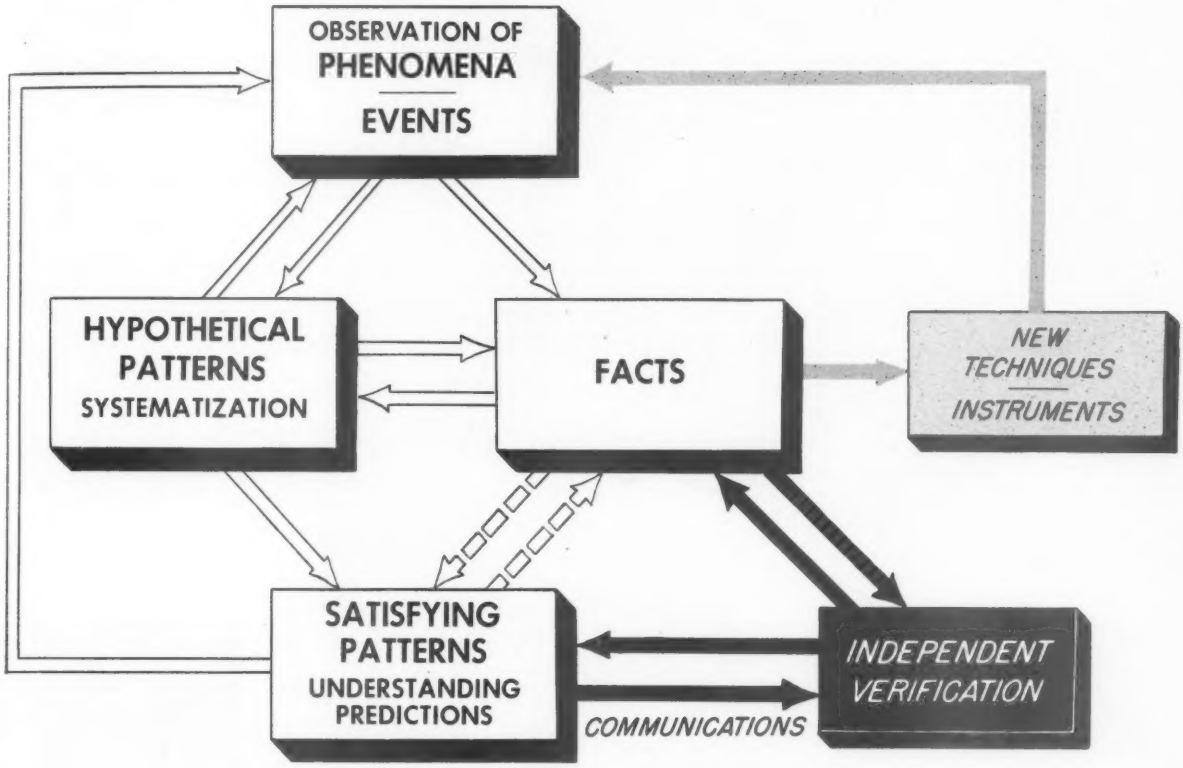
The product of this circuit is a satisfying pattern or theory (lowest white box) which enables us to understand the phenomena or events in the field of study, which comprehends all the facts, links them with the facts from other fields, and enables us to predict verifiable new phenomena or events. The black arrows represent some interactions arising from communications; facts and theories are verified and extended by placing them before other workers for scrutiny, repetition, and elaboration. Free and open discussion based on quantitative communications is an intrinsic part of the development of facts and patterns in science.

Finally, there is the gray circuit with its feedback. Although I have referred to new substances, new particles, new instruments, new techniques as "by-products" in the quest for understanding, I do not mean to underestimate their importance in any way. In order to extend and integrate their patterns, to assay their consistency over wide ranges of facts, scientists have found it necessary to seek for facts in every region susceptible to precise observation. The substances, instruments, and techniques discovered and developed in the course of one series of researches may be used to explore into new regions for more facts. The build-up in the circuit due to this positive feedback has been most spectacular; indeed the history of natural philosophy is marked by milestones, each indicating the discovery of a new device or technique which opened up to human experience regions that were hitherto inaccessible. These devices were means to an end, but the end would never have been achieved without the means. Telescopes, microscopes, x-rays, radioactivity, cyclotrons, chemical analysis, electronics, high-speed computing machines—all have been means of opening up new continents for valid experiences.

The white arrow leading into the top box (observations of phenomena and events) also indicates a positive feedback, the autocatalytic effect of understanding. A satisfactory theory or pattern of facts broadens and deepens understanding, pointing the way to new fruitful fields where facts of significance, interest, and potential for application are likely to be discovered. It helps research men make more intelligently the most important decision of all: the choice of problems in which to invest years of their lives. With the aid of new instruments, techniques, and methods, both experimental and theoretical, these decisions may be implemented and the investigators may pursue their researches into new and more complex fields with increasing facility and confidence.

Indeed, there is no loop in the diagram where negative feedback exists. The reader who is familiar with electronics, automatic control, the theory of chemical equilibrium, or cybernetics, will recognize at once that this is a condition for rapid—nay, even explosive—build-up of activity in the system. Indeed, we may reasonably conclude that built into scientific research itself is a mechanism that can produce a continually accelerating expansion. Since there is no negative feedback, we may conclude that the damping which prevents the explosive expansion of science is of the friction type. Poor "communications" are one such factor. Shortage of men and women of the caliber and education needed for research is another factor, and a third arises from the shortage of financial support to pay for the instruments needed to wrest her secrets from nature.

The circuit labeled "communications" has already been touched upon in the argument that exact or quantitative communicability is an essential characteristic of a scientific fact or theory. Without such a characteristic, verification by reproducibility would be impossible. We could imagine all the processes on the diagram except those



REGENERATIVE CIRCUITS--PURE SCIENCE (See text)

shown in black as occurring in the minds of one man or a tightly knit group. The black circuit of necessity brings in outside minds and makes the subject a public one. The surge and resurge of ideas by passage from one mind to another have played a dominant role in the growth of science. In fact, scientific research has been characterized by an interesting sort of teamwork among men with different kinds of mind.

AMONG productive research workers there are to be found at least six types of mind, which we can recognize by studying the authors of articles in the better journals or more penetrating works in the history of science. (The following classification is backed by no professional authority but is merely the conclusion of an unsophisticated observer.) These kinds of mind are: (a) the Promethean; (b) the critical or analytical; (c) the cumulative and inductive; (d) the cumulative and descriptive; (e) the meticulous; (f) the routine-industrious. It is evident that more than one of these attributes will be found in any given individual, although one will generally predominate.

The Promethean mind tries to inject something radically new into anything it does. It may provide the flash of genius that shows up a continent of knowledge or gives rise to a new all-embracing theory. It may just invent an easier and better way of performing an experiment or making a commodity. It is a mind that transmutes ideas from one field of experience to another and sketches in the broader patterns.

The critical or analytical mind takes nothing for granted, but examines keenly all statements presented to it, probing deeply into their consequences for consistency and rigor. It is the questioning mind so needed for clarification of complex situations, for establishing the validity of experience, and for determining the consistency of patterns.

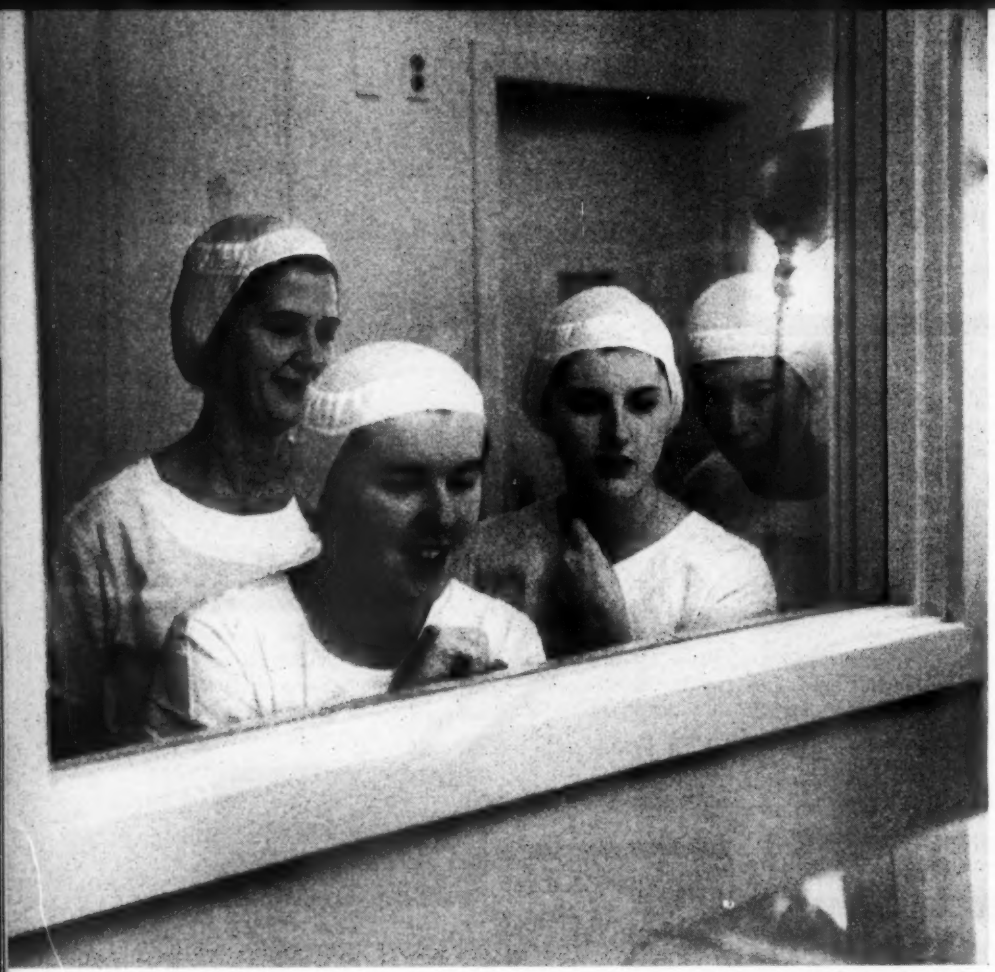
The cumulative-inductive mind ranges in the literature and in experiment, collecting facts and attempting to put them roughly in order. It is a type of mind that has contributed, for example, largely to physical chemistry. It is a type of mind that invents local elements of pattern.

The cumulative and descriptive mind is that of the trained and keen observer who remembers what he sees and describes it clearly for others to read. It is the mind that has laid the foundations of the complex sciences of astronomy, geology, and natural history. It is always evident on the frontiers of knowledge and is the stock-in-trade of the effective teacher.

The meticulous mind is concerned about the correctness of all details in observation, procedure, and processes. It is concerned with the search for accuracy and precision. Finally, we have the routine-industrious mind that follows through relentlessly, especially where many experiments are needed to establish one fact and where repetitive processes are of the essence.

HISTORY has shown that all these mental attributes have important roles to play in the sound and steady growth

Continued on page 26



Nurses pause before beginning their morning routine to observe activity in premature nursery at Johns Hopkins.

Tiny infants, w

PREMATURE NURSERY

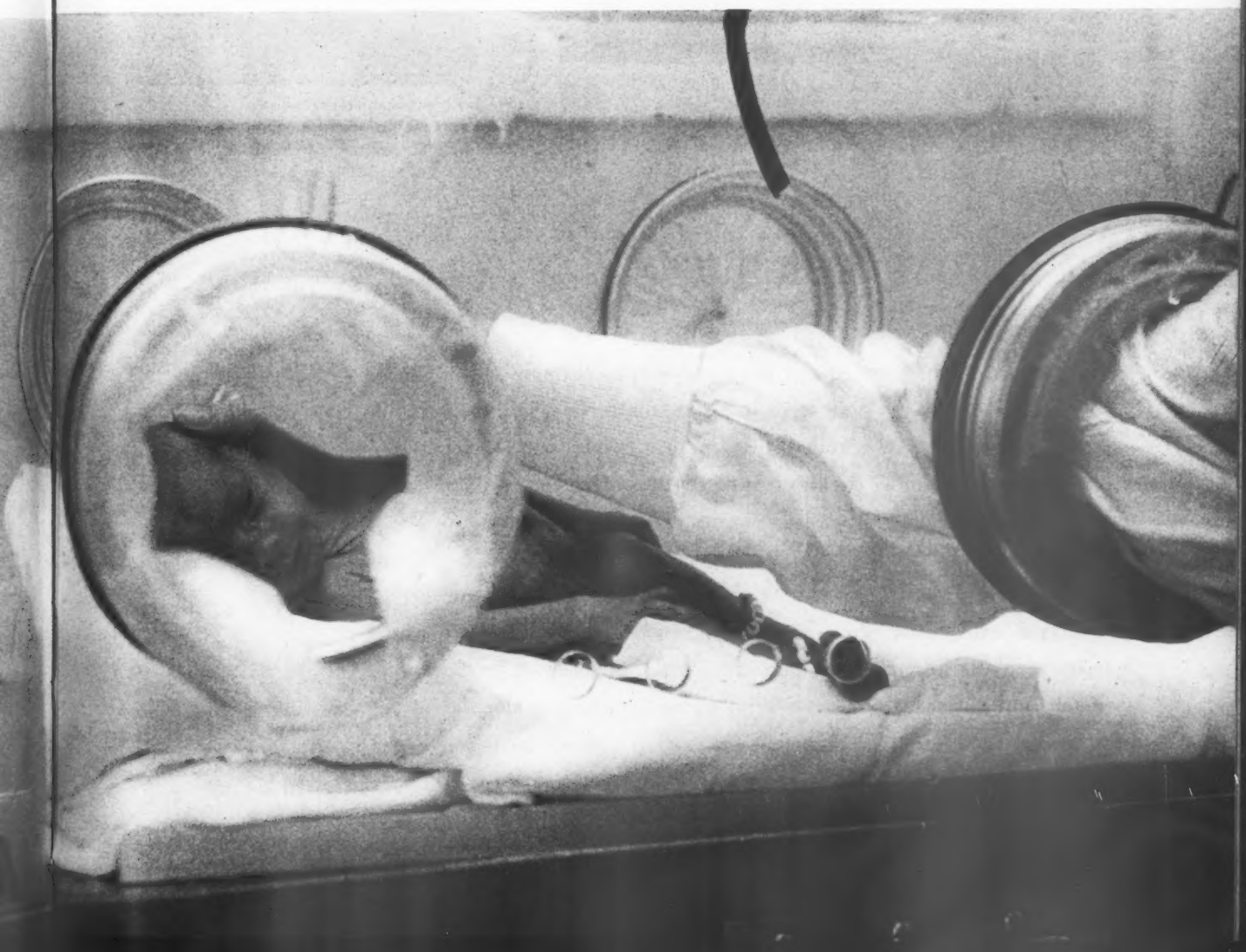
Photographs for The Johns Hopkins Magazine by Werner Wolff, Black Star

Reaching through porthole of ➤ incubator, a nurse adjusts position of a premature infant. Tube at top is for feeding.

nts,

who once only rarely survived, now have a good chance to live

THE premature nursery pictured on these pages, part of the Harriet Lane Home of the Johns Hopkins Hospital, is a unit designed exclusively for the care of infants weighing five and a half pounds or less at birth. Premature babies require special handling from the moment they are born. Time was when they had little chance to live. But now, rushed to the nursery from the delivery room (*see the next page*), or brought in portable incubators if they are born at home or in hospitals without the elaborate facilities needed for their care, they stand a good chance to survive. For a photographic view of the care they receive, turn the page.



PREMATURE NURSERY

Continued

Incubator, for which delivery-room personnel had phoned, is waiting for baby at nursery.

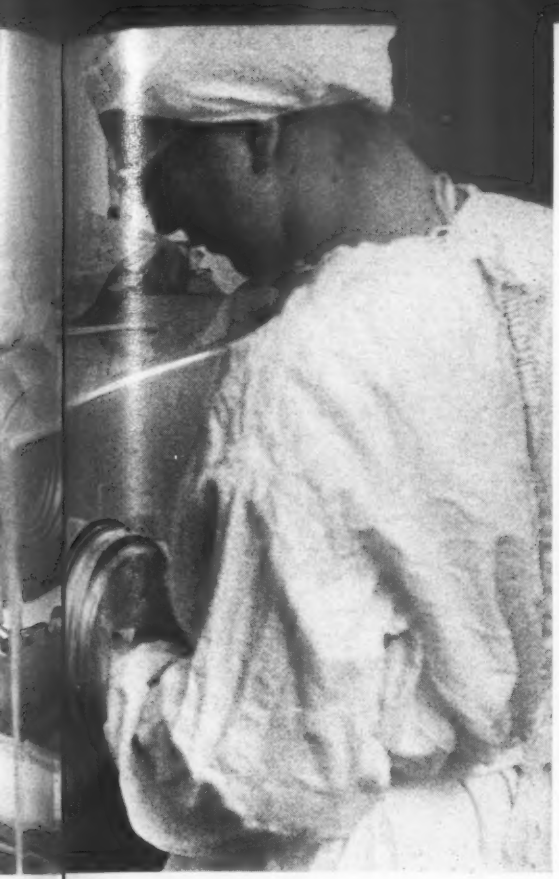
Only minutes old, a baby born prematurely is rushed by a doctor from Johns Hopkins delivery room to the nursery.

Without being removed from incubator, in which humidity, heat, oxygen are controlled, baby has medical examination.

THE FIGHT FOR LIFE

WHILE the premature baby is very small, he is unable to maintain his body temperature. So he is kept in an incubator in which heat, humidity, and oxygen are completely controlled. For the first twenty-four to forty-eight hours, he receives almost constant nursing care; after that critical period has passed, each baby still requires an average of six hours' individual nursing care each day.

For tiny infants in the controlled-air incubators, clothing is neither necessary nor desirable; it interferes with easy movement and observation. A baby weighing less than two and a half pounds is fed by gavage (via a stomach tube) in order not to tire him unduly. As an intermediate step, between gavage and bottle feedings, he gets his food by medicine dropper.

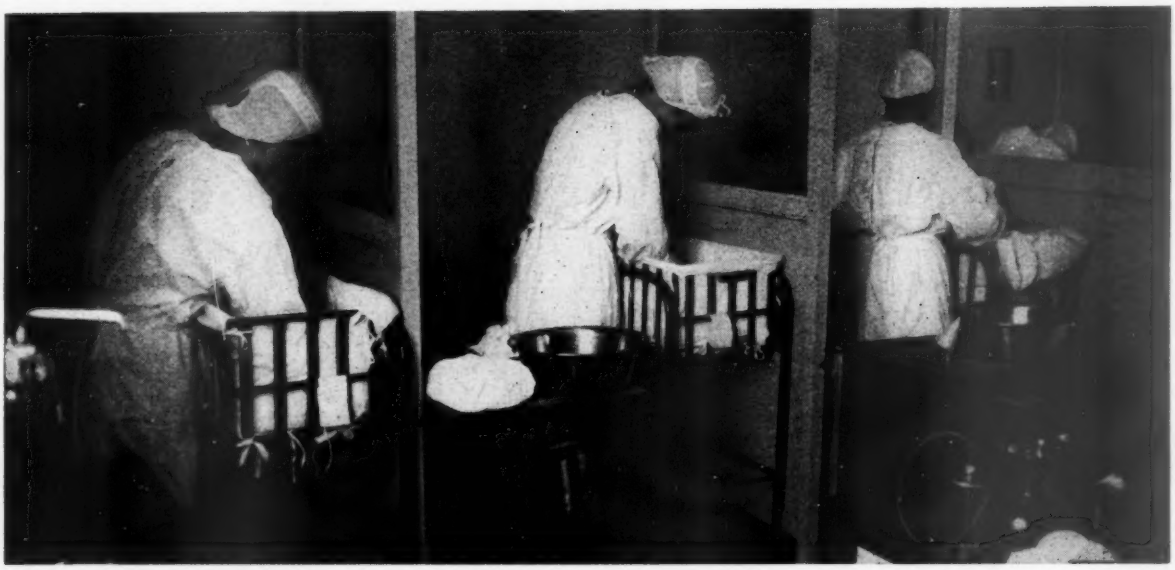


Weight is taken as soon as possible after birth. But all examinations will be postponed if condition is precarious.

To avoid tiring, infant is fed by tube passed into stomach. Incubator remains sealed as nurse works through portholes.

The temperature is measured hourly for first four hours and then every four hours. Incubator maintains body heat.

To clean the incubator, nurse again uses porthole entrances. Baby is unclothed to permit observation, free movement.

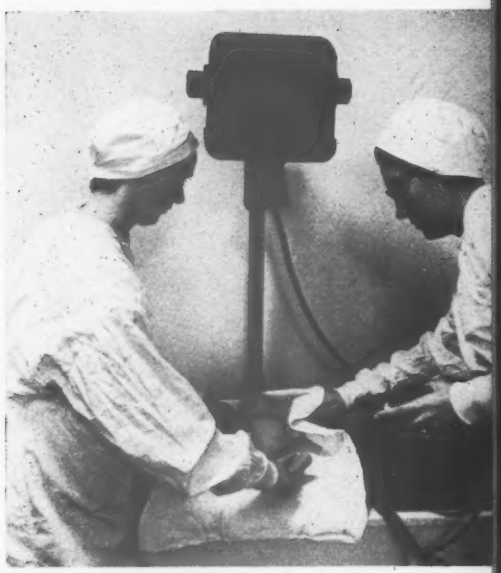


Being readied for their baths, babies in bassinets weigh four pounds or more. Bathtime is a busy hour for all hands in nursery.

BATHS, BOTTLES, AND BASSINETS

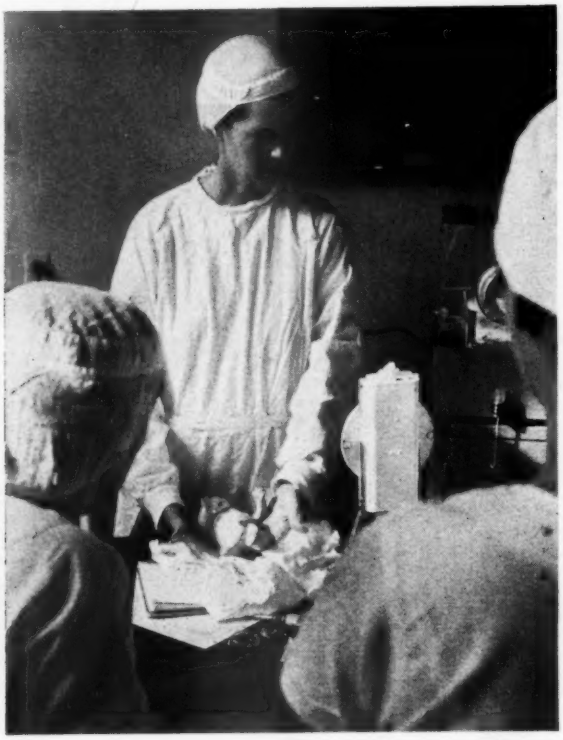
ONCE the premature baby is able to maintain his own body temperature, he is moved to a bassinet. He is introduced to his bath, a luxury he is denied until he has reached four pounds. Like all babies he spends most of his time asleep. When he is bottle-fed, it is in old-fashioned comfort. No modern development, Johns Hopkins doctors believe, has proved better than the old rocking chair.

Still tiny but now strong enough to be bottle-fed, a baby receives his meal while being gently rocked by a time-honored method. ➤



As soon as their condition permits, all babies are x-rayed. Masks actually may breed germs, are not worn by nurses.

Nurses' station and chartroom is hub of nursery. All traffic, whether it be babies or supplies, is controlled from here.



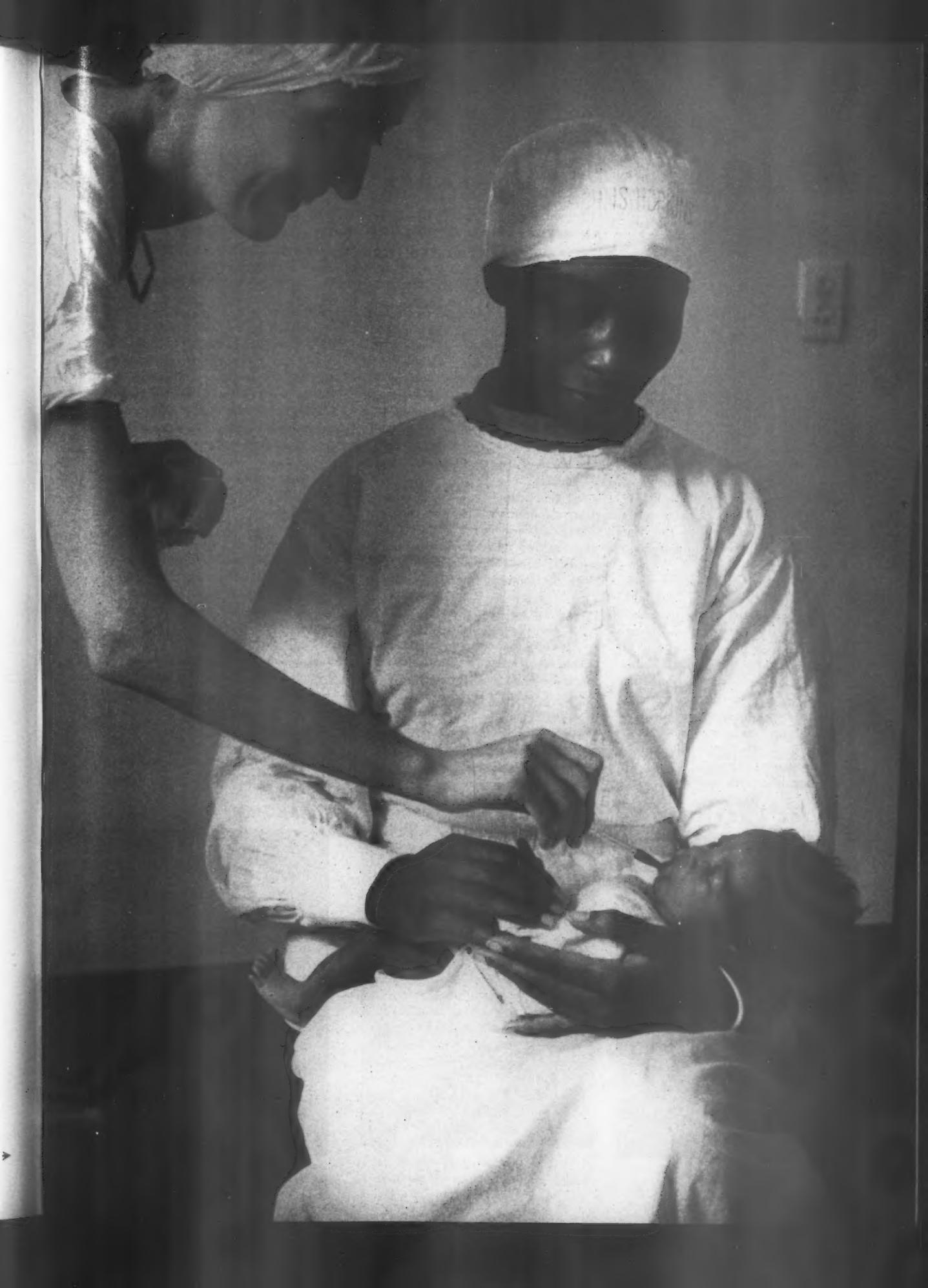
Mothers and nurses are taught how to handle babies in the nursery. Instructor uses a doll, dummy incubator in training.

Hopkins follows up the progress of babies through visiting-nurse program and return visits of the nursery's "alumni."

TRAINING FOR LIFE AT HOME

WHEN the baby weighs about five pounds, he moves to the discharge nursery, where atmospheric conditions resemble those he will meet at home. His parents are asked to start coming to the nursery at regular intervals. After they are capped and gowned they are admitted to the demonstration room (*above*), where the baby is brought to them. They are taught to bathe him, clothe him, play with him. They learn to regard him as a normal baby, and they are helped to overcome the anxiety they naturally feel because their child is so small.

A mother, who has visited her baby at regular intervals in the nursery, holds child as he receives vitamin drops before discharge. ➤



A Johns Hopkins Gazette

AN UNOFFICIAL COMPENDIUM OF FACULTY AND ALUMNI APPOINTMENTS, HONORS, AND ACCOMPLISHMENTS

VICE PRESIDENT

To the vice presidency of the Johns Hopkins Hospital and University, a post that has been vacant since Lowell J. Reed retired from it in 1952, the boards of trustees of the two Hopkins institutions this month named one of the leading men in American medicine, W. Barry Wood, Jr.

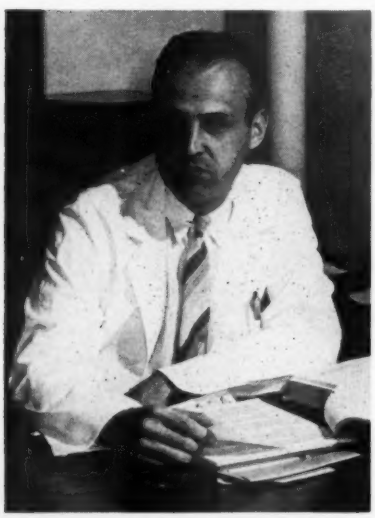
Dr. Wood, who is forty-five years old, is presently professor of medicine and head of the department of medicine at Washington University in St. Louis. He will take over his Johns Hopkins duties in the fall. In addition to the vice presidency, he will hold a professorship of microbiology.

Only six years after receiving his M.D. at Johns Hopkins in 1936, Dr. Wood was appointed to the professorship of medicine at Washington University, and also as physician in chief at Barnes Hospital in St. Louis. He had graduated *summa cum laude* from Harvard College in 1932, where he was captain of the varsity football team (and, in 1931, all-American quarterback) and a member of the varsity baseball, hockey, and tennis teams as well.

His scientific work has been chiefly in microbiology, dealing particularly with the mechanisms by which the body defends itself against bacterial infection. His latest studies have been of inflammation and causes of fever. He has published widely, and his works are considered to be classics in the field.

Dr. Wood is a member of the board of overseers of Harvard College and of the board of trustees of the Rockefeller Foundation.

At Johns Hopkins his chief administrative concerns will be with coordinating the activities of the Medical Institutions as they relate to patient care and medical education and research, and with development of the institutions.



W. Barry Wood, Jr.

THE FACULTY

Among members of the Board of Trustees, Detlev W. Bronk has been appointed to the National Advisory Health Council.

Vannevar Bush, president of the Carnegie Institution of Washington, has been awarded the William Procter Prize given by the Scientific Research Society of America for general scientific achievement.

Christian A. Herter, governor of Massachusetts, has received the honorary degree of doctor of laws from Springfield College.

Merle A. Tuve, Ph.D. '26 (Physics), Sc.D. (Hon.)'50, has been elected to a four-year term as an alumni trustee of the University. Dr. Tuve has been awarded the Howard N. Potts Medal by the Franklin Institute.

In the School of Hygiene, Winston H. Price, associate professor of biochemistry, was named winner of the Theobald Smith Award in the medical sciences at the recent meeting of the American Association for the Advancement of Science.

Blair E. Batson, instructor in public health administration, has been promoted to assistant professor of pediatrics.

Paul V. Lemkau, professor of public health administration and lecturer in psychiatry, has been granted a leave of absence to become director of the New York City Mental Health Board.

In the Faculty of Philosophy, Charles R. Anderson, professor of English, was sent to Japan last summer by the Department of State to lecture and to conduct a three-week seminar in American literature.

Richard H. Howland, assistant professor of art, has been elected vice president of the Society of Architectural Historians.

Walter S. Koski, associate professor of chemistry, has been promoted to professor of chemistry, effective July 1.

Friederich I. Mautner, assistant professor of mathematics, has been promoted to associate professor of mathematics, effective July 1.

Elmer V. McCollum, professor emeritus of biochemistry, has been honored by having his portrait presented to the University by a group of his associates.

Malcolm C. Moos, professor of political science, is on leave of absence as visiting professor at the University of Michigan, for the second semester of this academic year.

ALUMNI TRUSTEE

Merle A. Tuve

A Letter To The Editor

To The Editor of The Johns Hopkins Magazine

At the January meeting of the Board of Trustees, President Reed asked that the Board proceed "with appropriate steps for the selection of the next President of the University."

Dr. Reed's long and distinguished service to the University impels the Trustees to do no less than to meet his wishes, much as we regret the close of our active association with him. The results of his work will have a lasting influence for good upon the University and will be long and gratefully remembered.

The Trustees recognize that the selection of a president is their most important single responsibility and is of concern to all those interested in the welfare of the University. Therefore, I take this opportunity to announce through your columns that the Board of Trustees has appointed a Committee to make recommendations to it concerning the selection of a successor to Dr. Reed as President of the University. This Committee is under the Chairmanship of Mr. Benjamin H. Griswold, III of Baltimore.

The importance of the task of the Committee requires that its work be undertaken as carefully as possible. As soon as possible after the recommendations of the Committee have been considered and acted upon by the Board of Trustees, announcement will be made of these actions.

Sincerely,
Carlyle Barton
President, Board of Trustees

Francis J. Pettijohn, professor of geology, has been elected president of the Society of Economic Paleontologists and Mineralogists for the coming year.

Alvin Nason has been promoted from assistant to associate professor of biology.

At the Applied Physics Laboratory, new staff members include Baylus R. Albritton, Clarence Andrews, Albert Boggess, III, John Christian, Allen Kropf, Raymond E. Lewkowicz, George Rawling, Edwin E. Westerfield, and Warren W. Yenney, Jr.

Samuel N. Foner has been presented the 1954 award for achievement in the physical sciences by the Washington Academy of Sciences.

Lawrence R. Hafstad, professor of physics, has been named atomic energy consultant for the Chase National Bank of New York.

In the School of Engineering, Alexander G. Christie, professor emeritus of mechanical engineering, has been elected a life member of the American Society of Engineering Education.

Ralph E. Gibson, director of the Applied Physics Laboratory, is president-elect of the Washington Academy of Sciences. He will assume office in 1956.

William H. Huggins, professor of electrical engineering, has been awarded the Air Force Decoration for Exceptional Civilian Service.

Abel Wolman, professor of sanitary engineering, has been appointed chairman of an eight-man committee to make a thorough study of the mass transportation problem in Baltimore and its suburbs.

At the Institute for Cooperative Research, Leslie T. Miller has been promoted to the position of executive assistant.

In the School of Medicine, C. Bernard Brack, assistant professor of gynecology, has been elected to the scientific board of directors of the American Cancer Society.

Alfred Blalock, professor of surgery and director of the department of surgery, has been awarded the honorary degree of doctor of science by Emory University.

W. Horsley Gantt, associate professor of psychiatry, is serving as visiting professor of pharmacology at the University of Puerto Rico.

Theodore C. Greene has been appointed assistant professor in anatomy, effective July 1.

William J. Hopkins, instructor in urology, has been promoted to assistant professor of urology.

Leo Kanner, associate professor of psychiatry and associate professor of pediatrics, was honored for his twenty-five years of work as head of the psychiatric clinic in the Harriet Lane Home at a banquet celebrating the twenty-fifth anniversary of that clinic.

NEW AND RETIRING HOSPITAL PRESIDENTS

HOLMES I. METTEE

Walter F. Perkins

JACK ENGEMAN

W. Frank Roberts

Amos R. Koontz, assistant professor of surgery, has been elected president of the Baltimore City Medical Society.

J. Earle Moore, associate professor of medicine and adjunct professor of public health administration, has been elected president of the Association for Research in Nervous and Mental Disease. Dr. Moore has also been named editor of the new *Journal of Chronic Diseases.*

Marvin M. Nachlas, B.A. '40, M.D. '43, has become assistant professor of surgery at the Medical School and attending surgeon at Sinai Hospital.

Donald G. Walker has been appointed assistant professor of anatomy, effective July 1.

BOOKS

The late Henry Carter Adams, PH.D. '78 (Political Economy): *Relation of the State to Industrial Action* and *Economics and Jurisprudence: Two Essays* (Columbia, $3).

Errett C. Albritton, M.D. '21, editor: *Standard Values in Metabolism and Nutrition* (Saunders, $6.50).

F. H. Bethell, M.D. '29, and others: *Symposium on Problems of Gerontology* (National Vitamin Foundation, $2.50).

Frederick S. Brackett, PH.D. '22 (Physics); FAC. '20–'22: *The Present State of Physics* (American Association for the Advancement of Science, $6.75).

Roland Wilbur Brown, PH.D. '26 (Geology): *Composition of Scientific Words* (National Museum, $8).

George E. Cartwright, M.D. '43: *Diagnostic Laboratory Hematology* (Grune and Stratton, $3).

Howard F. Conn, M.D. '39: *Current Therapy, 1955* (Saunders, $11).

Jay N. Darling, LL.D. '20 (hon.): *As Ding Saw Hoover* (Iowa State, $2.75).

Joseph D. H. Donnay, professor of crystallography and mineralogy, and Werner Nowacki: *Crystal Data* (Geological Society of America, $5).

Halbert L. Dunn, FAC. '25–'29 (Hygiene), editorial director: *Vital Statistics of the United States, 1950.* Vol. I: *Analysis and Summary Tables with Supplemental Tables for Alaska, Hawaii, Puerto Rico and Virgin Islands* (Government Printing Office, $3.50).

Paul H. Emmett, FAC. '37–'44 (Chemistry and Gas Engineering), editor: *Catalysis.* Vol. I: *Fundamental Principles* (Reinhold, $10).

Ernest Carroll Faust, FAC. '23–'24 (Hygiene): *Animal Agents and Vectors of Human Disease* (Lea and Febiger, $9.75).

Eric F. Goldman, M.A. '35, PH.D. '38, FAC. '38–'42 (History): *Charles A. Beard: An Appraisal* (Kentucky, $4.50).

J. P. Greenhill, M.D. '19, House Staff '19–'20 (Gynecology), editor: *The Year Book of Obstetrics and Gynecology* (Year Book, $6).

Arthur E. Gordon, PH.D. '29 (Latin): *Potitus Valerius Messalla, Consul Suffect 29 B.C.* (University of California, $.50).

Jerome S. Harris, House Staff '48–'49 (Obstetrics), Irwin H. Kaiser, M.D. '42, House Staff '42–'43 (Obstetrics), and S. R. M. Reynolds: *Clinical Measurement of Uterine Forces in Pregnancy and Labor* (Thomas, $9.50).

Roger M. Herriott, professor of biochemistry, editor: *Symposium on Nutrition: The Physiological Role of Certain Vitamins and Trace Elements,* with foreword by E. V. McCollum, professor emeritus of biochemistry (Johns Hopkins, $6).

William S. Hoffman, B.A. '18, PH.D. '22 (Chemistry), FAC. '22–'27 (Physiology): *The Biochemistry of Clinical Medicine* (Year Book, $12).

Lee M. Hollander, B.A. '01, PH.D. '05 (German) and Carl F. Bayerschmidt: *Njal's Saga* (American Scandinavian Foundation, $6.50).

Clay Hunt, PH.D. '41 (English): *Donne's Poetry: Essays in Literary Analysis* (Yale, $3.75).

Rockwell D. Hunt, PH.D. '95 (History): *California in the Making* (Caxton Printers, $6).

Georgeanna Seegar Jones, M.D. '36, assistant professor of gynecology: *The Management of Endocrine Disorders of Menstruation and Fertility* (Thomas, $5.75).

I. Newton Kugelmass, PH.D. '21 (Chem.): *The Management of Mental Deficiency in Children* (Grune and Stratton, $6.75).

Simon Kuznets, professor of political economy, editor, with others: *Income and Wealth,* Ser. I; Ser. II, *Income and Wealth of the United States: Trends and Structures;* Ser. III (Johns Hopkins, Ser. I, $4.25; Ser. II and III, $5 each).

Bernard Lown, M.D. '45, and Samuel A. Levine: *Current Concepts in Digitalis Therapy* (Little, Brown, $3.50).

Chester Lynxwiler, FEL. '48–'49 (Pediatrics), and Vincent Moragues: *Cardiac Anomalies* (Williams and Wilkins, approx. $8).

Ralph H. Major, M.D. '10, House Staff '10–'12, FAC. '11–'13 (Medicine): *A History of Medicine,* Vols. I and II (Thomas, $14.50).

Joseph F. McCloskey, Operations Research Office, and Florence N. Trefethen, editors: *Operations Research for Management* (Johns Hopkins, $7.50).

William D. McElroy, professor of biology and director of the McCollum-Pratt Institute, and Bentley Glass, professor of biology, editors: *Amino Acid Metabolism* (Johns Hopkins, $12.50); and *The Mechanism of Enzyme Action* (Johns Hopkins, $11).

H. Houston Merritt, M.D. '26; *A Textbook of Neurology* (Lea and Febiger, $12.50).

Russell H. Morgan, professor of radiology, editor, *Handbook of Radiology* (Year Book, $10).

Victor A. Najjar, associate professor of pediatrics, editor: *Fat Metabolism* (Johns Hopkins, $4.50).

Leonardo Olschki, FAC. '39–'40 (Romance Languages and History): *The Genius of Italy* (Cornell, $5).

Harry M. Orlinsky, FEL. '36–'41, G. '41–'44 (Oriental Seminary): *Ancient Israel* (Cornell, $2.50).

Emil Ott, FEL. '28–'29, FAC. '29–'33 (Chemistry), Mildred W. Grafflin, G. '29–'30 (Chemistry), and Harold M. Spurlin, editors: *Cellulose and Cellulose Derivatives,* part 1 (Interscience, $12).

Emil Ott, FAC. '28–'33 (chemistry), Mildred W. Grafflin G. '29–'30 (Chem.), and Harold Spurlin, editors: *Cellulose and Cellulose Derivatives,* Part 2 (Interscience $12).

Talmage L. Peele, FEL. '37–'38 (Anatomy): *The Neuroanatomical Basis for Clinical Neurology* (McGraw-Hill, $12.50).

Jacques J. Polak, FAC. '49–'50 (Political Economy): *An International Economic System* (Chicago, $4.75).

Lynn Poole, director of public relations: *Science, the Super Sleuth* (McGraw-Hill, $2.75).

Sidney Raffel, B.A. '30, SC.D. '33 (Hygiene), FAC. '34–'35 (Immunology), associate editor, with Charles E. Clifton, editor, and Roger Y. Stanier, associate editor: *Annual Review of Microbiology,* Vol. VIII (Annual Reviews, $7).

David T. Smith, M.D. '22, House Staff '22–'23 (Pediatrics), Roger D.

Baker, FAC. '28–'30, House Staff '28–'29 (Pathology), Donald S. Martin, B.A. '25 (with Norman F. Conant and Jasper L. Callaway): *Manual of Clinical Mycology* (Saunders, $6.50).

William Wallace Scott, professor of urology, and Perry B. Hudson: *Surgery of the Adrenal Glands* (Thomas, $3.50).

Edward Dennis Sokol, B.A. '47, PH.D. '52 (History): *The Revolt of 1916 in Russian Central Asia* (Johns Hopkins, $3.25).

George S. Stevenson, M.D. '19, House Staff '19–'20 (Psychiatry) editor: *Administrative Medicine* (Josiah Macy, Jr. Foundation, $3).

Lloyd G. Stevenson, PH.D. '49 (History of Medicine): *Nobel Prize Winners in Medicine and Physiology: 1901–1950* (Schuman, $6.50).

Harold J. Stewart, B.A. '15, M.D. '19, M.A. '23 (Medicine): *Cardiac Therapy* (Hoeber, $10).

George J. Thaler, B.E. '40, DR. ENG. '47, and Robert G. Brown: *Servomechanism Analysis* (McGraw-Hill, $7.50).

Ilza Veith, M.A. '44 (History), PH.D. '47 (History of Medicine), editor: *Perspectives in Physiology* (American Physiological Society, $3).

Patrick R. Vincent, PH.D. '52 (Romance Languages): *The* Jeu De Saint Nicolas *of Jean Bodel of Arras: A Literary Analysis* (Johns Hopkins, $2.50).

Elmer G. Wakefield, M.D. '25: *Clinical Diagnosis* (Appleton-Century-Crofts, $22.50).

Arthur P. Whitaker, FAC. '51–'52 (SAIS): *The United States and Argentina* (Harvard, $4.75).

Benjamin H. Willier, Henry Walters professor of zoology, Paul Weiss, and Viktor Hamburger: *Analysis of Development* (Saunders, $15).

Joseph Wortis, House Staff '38–'39 (Psychiatry): *Fragments of an Analysis With Freud* (Simon and Schuster).

THE ALUMNI

Arthur L. Bloomfield, B.A. '97, M.D. '11, House Staff '11–'20, FAC. '12–'26 (Medicine), is now professor emeritus of medicine at Stanford University.

Donald M. Liddell, B.A. '00, has been elected president of the Mining and Metallurgical Society of America.

A. Raymond Dochez, B.A. '03, M.D. '07, FAC. '19–'21 (Medicine), has been awarded an honorary doctor of science degree by Columbia University.

Atherton Seidell, PH.D. '03 (Chemistry), has been honored by the American Documentation Institute for his pioneer work in the extension of library services to scientists by microfilm.

Henry S. Conard, Johnston Scholar '04–'06 (Botany), is the first recipient of a newly established award of the Ecological Society of America for outstanding service to ecology.

H. Boyd Wylie, '05–'08 (Arts), will retire as dean of the University of Maryland School of Medicine next July 1.

Hermann I. Schlesinger, FAC. '06–'07 (Physiological Chemistry), has been awarded an honorary degree by the University of Chicago.

Charles G. Fenwick, PH.D. '11 (Political Science), received the 1954 peace award of the Catholic Association for International Peace.

Harry C. Schmeisser, B.A. '08, M.D. '12, PH.D. '14 (Pathology), FAC. '14–'19, has been appointed professor emeritus at the University of Tennessee and consultant to the City of Memphis hospitals. He has retired from active teaching after thirty-three years at the University of Tennessee.

Biology Geology History Music Pharmacology Mathematics Psychology Language
Physics Literature Archaeology Latin Chemistry Medicine Philosophy Arts Engineering

Stanhope Bayne-Jones, M.D. '14, M.A. '17 (Pathology), House Staff '14–'15 (Medicine), '15–'17 (Pathology), FAC. '15–'17 (Pathology), '17–'23 (Bacteriology), has been awarded an honorary doctor of science degree by Emory University.

William C. von Glahn, M.D. '15, FAC. '17–'18, '19–'20, House Staff '17–'19 (Pathology), has retired as chairman of the department of pathology at New York University College of Medicine and is now professor of pathology at Louisiana State University. Dr. von Glahn has been succeeded at New York State University by Lewis Thomas, FAC. '46–'48 (Pediatrics).

Walter B. Martin, M.D. '16, House Staff '16–'17, was elected president of the Johns Hopkins Medical and Surgical Association at the last association meetings.

Cyrus Cressey Sturgis, M.D. '17, has been awarded the honorary degree of doctor of science by Emory University.

Martha May Eliot, M.D. '18, recently received an honorary citation from Radcliffe College.

Mary Van Rensselaer Buell, FAC. '21–'30 (Physiological Chemistry), '30–'45 (Medicine), has been appointed associate professor of biochemistry at the University of Chicago.

John Black Grant, C.P.H. '21, M.P.H. '39, has been awarded the honorary degree of doctor of science by Acadia University, Nova Scotia.

Willard S. Paul, B.S. '24, FAC. '21–'24 (Military Science and Tactics), has been appointed chairman of a newly created commission for planning national censorship under the Office of Defense Mobilization.

Millicent Carey McIntosh, PH.D. '26 (English), has been honored by the establishment at Barnard College of an English professorship bearing her name. Dr. McIntosh was awarded an honorary degree by the Johns Hopkins University on Commemoration Day for her outstanding services to education as president of Barnard College.

Fuller Albright, House Staff '27–'28 (Medicine), has been made an honorary professor at the San Marcos University of Lima for outstanding work in endocrinology.

Grady F. Mathews, G. '27–'28 (Hygiene), has been given the Arthur J. McCormick Award by the Association of State and Territorial Health Officers for an outstanding contribution to public health.

W. Clifford M. Scott, FAC. and House Staff '28–'29 (Psychiatry), has been appointed associate professor of psychiatry at the University of Montreal.

H. Jackson Davis, DR.P.H. '29, has been appointed health director of Bucks County, Pennsylvania.

Milton H. Medenbach, B.A. '29, has been elected president of the Boarding School Association of the Philadelphia Region.

Venila L. Shores, PH.D. '29 (History), has retired as head of the department of history at Florida State University.

Joseph K. Cline, M.A. '30, PH.D. '34 (Chemistry), has been elected treasurer of the Southern Society of Cancer Cytology.

Maurice D. Meyers, B.E. '30, has been assigned as commanding officer of the Forty-First Engineer Battalion, Tenth Infantry Division, Fort Riley, Kansas.

Hugo Muench, M.P.H. '31, DR.P.H. '32, has resigned as assistant dean of the Harvard Faculty of Public Health. He will be succeeded by Hugh R. Leavell, House Staff, '28–'29 (Urology), FAC. and House Staff, '29–'30 (Medicine).

Louis J. Soffer, B.S. '32, has been appointed clinical professor of medicine at the State University of New York College of Medicine.

Israel Chodos, B.A. '33, has been named rabbi of Sinai Temple in Los Angeles.

Lawrence P. Hafstad, PH.D. '33 (Physics), FAC. '46–'54, has been granted the Atomic Energy Commission's distinguished service award.

Morton E. Rome, B.A. '33, has been elected vice president of the Bar Association of Baltimore City.

R. Bowen Hardesty, G. '33–'34 (Education), has been made president of the Frostburg State Teachers College, Maryland.

James Franck, FAC. '34–'38 (Physics), has been awarded the 1955 Rumford Medal of the American Academy of Arts and Sciences for his work in photosynthesis.

Church Yearley, B.S. '34 (Economics), has been promoted to vice president of the First National Bank of Atlanta.

Edna Page, '34–'35 (Dietetics), has been appointed associate professor of foods and nutrition at Colorado A. and M. College.

Gaetano F. D'Alelio, PH.D. '35 (Chemistry), has been appointed head of the department of chemistry at Notre Dame University.

John Trubin, '35–'36 (Arts) has been appointed first assistant attorney general of New York State.

Weston Maynard Kelsey, M.D. '36, House Staff '36–'38 (Surgery and Pediatrics), has been appointed professor and director of the department of pediatrics at Wake Forest University.

Frank Calderone, C.P.H. '37, M.P.H. '39, has resigned as director of medical services for the United Nations.

Dulany Foster '37–'42 (McCoy College), has been appointed by Governer McKeldin to be chief judge of the Baltimore Orphans' Court.

Robert B. Lawson, House Staff '37–'38 (Pediatrics), has been appointed professor of pediatrics at the University of Miami, Florida.

Clayton G. Loosli, House Staff '37–'38 (Medicine), has been elected president of the Central Society for Clinical Research.

Myrick W. Pullen, Jr., B.A. '37, M.D. '41, has been elected vice president of the Utah Psychiatric Society.

Ted Bloodhart, '39–'40 (Medical Arts), is chief of medical illustration at the School of Medicine and Surgery, University of California at Los Angeles.

Robert H. Krieble, PH.D. '39 (Chemistry), has been appointed manager of the chemical development department of the General Electric Company's chemical and metallurgical division.

Herbert M. Bosch, M.P.H. '40, has been named an honorary fellow of the Royal Sanitary Institute.

John C. Broughton, PH.D. '40 (Geology), has been apointed head of the newly formed New York State Geological Survey, which combines the offices of geology and paleontology in a single administrative and scientific unit.

Marcolino G. Candau, M.P.H. '41, has been named an honorary fellow of the Royal Sanitary Institute.

Boris Ephrussi, FAC. '41–'42 (Genetics), '42–'45 (Biology), served as an exchange professor at Harvard University for the fall term. He is now on the faculty of the University of Paris.

Ernest M. Gruenberg, M.D. '41, has assumed his duties as a senior member of the technical staff in charge of the Milbank Memorial Fund's mental health activities.

John A. Kahl, M.P.H. '41, was presented a citation from the President's committee on employment of the physically handicapped "in recognition of his outstanding efforts expended in promoting equal opportunity in employment for the physically handicapped."

Luis F. Thomen, M.P.H. '42, DR.P.H. '43, is ambassador of the Dominican Republic in London, and represents the Dominican Republic as minister at the Hague.

John Brown Macnab, B.A. '43, has been appointed associate pastor of the First Presbyterian Church of New York.

John J. Osborn, M.D. '43, House Staff '44 (Pediatrics), is acting associate professor of medicine at Stanford University.

F. Frederick Ruzicka, M.D. '43, has been promoted to clinical professor of radiology at New York University Postgraduate Medical School.

Kenneth Sterling, M.D. '43, is assistant professor of medicine at the State University of New York, Upstate Medical Center.

Alvin J. Cummins, M.D. '44, House Staff '44–'45 (Pediatrics), has been appointed assistant professor of medicine at the University of Tennessee Medical College.

William H. Muller, Jr., FAC. and House Staff, '44–'46, '48–'49 (Surgery), has been appointed professor of surgery and chairman of the department of surgery at the University of Virginia Medical School.

Edward Colton Meek, Jr., M.D. '44, has been appointed assistant professor in the department of pathology at the University of Oregon Medical School.

Theodore E. Woodward, FAC. '46–'54 (Medicine), has been awarded an honorary doctor of science degree by Franklin and Marshall College.

Arthur C. Banks, Jr., G. '47–'49 (Political Science), has been appointed assistant dean of Morgan State College, Maryland.

Howard L. Balsley, G. '47–'48 (Political Economy), has been appointed professor of business statistics at Louisiana Polytechnic Institute.

Jacob Colsky, FAC. '47–'52 (Preventive Medicine), has been promoted to assistant professor of medicine at the State University of New York.

Gustavo Correa, PH.D. '47, FAC. '47–'48 (Romance Languages), has been appointed associate professor of Spanish literature at the University of Chicago.

Chandler A. Stetson, Jr., FAC. '47–'48, has been named associate professor of pathology at New York University College of Medicine.

Ray Elbert Trussell, M.P.H. '47, has been named executive officer of the newly organized School of Public Health and Administrative Medicine at Columbia University. He was also named DeLamar Professor of Administrative Medicine and associate dean for public health in the Faculty of Medicine, effective July 1.

Philip L. Walker, Jr., B.E. '47 M.S. '48 (Engineering), G. '49–'50 (Chemical Engineering), has been appointed associate professor and head of the department of fuel technology at the Pennsylvania State University.

John Z. Bowers, FAC. '48–'50 (Preventive Medicine), will become dean of the University of Wisconsin Medical School on July 1.

Lloyd J. Davidson, FAC. '48–'51 (English), has been named dean of the Virginia Military Institute faculty.

Robert W. McCollum, Jr., M.D. '48, is assistant professor of preventive medicine at the Yale University School of Medicine.

Kenneth G. Wolfson, M.A. '48, G. '48–'51 (Mathematics), has been promoted to the rank of assistant professor of mathematics at Rutgers University.

Wayne V. Burt, FAC. '49–'53 (Oceanography), has been appointed associate professor of oceanography at Oregon State College.

William A. Harris, M.P.H. '49, has been appointed assistant dean for postgraduate medical education at the State University of New York College of Medicine at Syracuse and simultaneously was promoted to assistant professor in public health and preventive medicine.

DEATHS

C. Delano Ames, G. '14–'15 (Political Science), January 29, 1955.

Marjorie Anderson, G. '22–'23 (English), November 29, 1954.

Norman George Angstadt, M.P.H. '40, September 18, 1954.

English Bagby, PH.D. '17, (Psychology), January 14, 1955.

Robert Freeland Barbour, G. '48–'49 (Biophysics), January 15, 1953.

John Greer Bartram, G. '15–'16 (Geology), February 18, 1955.

George Chester Basil, Jr., FAC. '36–'41 (Medicine), December 5, 1954.

John Merryman Black, B.A. '09, February 23, 1955.

William Symington Bole, M.D. '10, November 8, 1954.

Gustav Bornscheuer, '19–'20, '27–'31 (McCoy), December 21, 1954.

Charles Prevost Boyce, '13–'16 (Arts), January 15, 1955.

Nora Virginia Brainard, B.S. '32, January 29, 1955.

Charles Pliny Brigham, B.A. '88, PH.D. '91 (Chemistry), November 28, 1954.

Murray Peabody Brush, PH.D. '98, FAC. '99–'19 (Romance Languages), dean of the faculty '17–'19, November 14, 1954.

H. Hays Bullard, M.D. '16, FEL. '16–'17, FAC. '18–'20 (Pathology), House Staff, '18–'20 (Medicine), December 12, 1954.

Ernest Clifford Burke, '15–'18 (Arts), November 27, 1954.

William Merriam Burton, PH.D. '89 (Chemistry), December 29, 1954.

Howard Lee Cecil, M.D. '13, House Staff '13–'17, '19–'20, November 12, 1954.

George Edward Chinn, M.D. '03, July 25, 1954.

Frank Angier Clarke, B.A. '93, November 23, 1954.

Ruth Steffens (Mrs. H. Walton) Cochran, Graduate Nurse '27, November 14, 1954.

Irvin Sol Cohen, B.A. '36, PH.D. '42 (Mathematics), February 16, 1955.

Owena Crumb (Mrs. Preston R.) Devoe, Graduate Dietitian '28, December 21, 1954.

Christian William Dittus, M.A. (hon.) '34, manager of the Johns Hopkins Press '08–'48, March 2, 1955.

Ernest Ferdinand DuBrul, G. '94–'96 (History), March 8, 1954.

George Clark Dunham, DR.P.H. '21, October 4, 1954.

Lionel Charles Durel, PH.D. '28 (Romance Languages), May 21, 1954.

Philip Saffery Evans, Jr., M.D. '99, FAC. '17–'18 (Physiology), FEL. '22–'23 (Hygiene), '30–'31 (Physiology), November 23, 1954.

Frank John Fahm, Jr., G. '27–'28 (Education), January 29, 1955.

Vivian Ezra Fisher, PH.D '25 (Psychology), September 10, 1954.

Harry Atwood Fowler, M.D. '01, House Staff '01–'02 (Medicine), November 18, 1954.

Frank Hamilton Fowler, G. '90–'91 (Greek), January 28, 1955.

Alice Elizabeth Frame, Graduate Nurse '08, January 13, 1955.

Madeline Rae Fuhrman, B.S. '50, November 26, 1954.

Matthew Germing, G. '03–'04 (Latin), August 8, 1954.

Henry Foote Gibbs, '25–'27 (Arts), B.E. '30, G. '30–'31 (Gas Engineering), October 12, 1954.

William Lee Gills, M.D. '12 May 27, 1954.

Otto Gminder, '97–'98 (Arts), December 16, 1954.

Calvin H. Goddard, B.A. '11, M.D. '15, February 22, 1955.

Bienvenido Maria Gonzalez, SC.D. '23 (Hygiene), December 30, 1953.

Lida H. Gosman, Graduate Nurse '02, February 8, 1955.

Harry Clinton Gossard, PH.D '14 (Mathematics), December 6, 1954.

Jerome B. Green, G. '44–'45 Mechanical Engineering, January 23, 1955.

Paul Harris, G. '39–'41 (Education), January 15, 1955.

William Patrick Healy, M.D. '00, November 7, 1954.

Frances Cushing Hewes, Graduate Nurse '05, January 22, 1955.

Robert Edmund Heyn, B.A. '26, November 29, 1954.

Dwight Lucian Hopkins, PH.D. '26 (Zoology), January 10, 1955.

Lucy Virginia Howard, Graduate Nurse '10, December 26, 1954.

Florence Adele Hunt, Graduate Nurse '99, December 30, 1954.

Garret Plowman Hynson, '28–'29 (Arts), G. '32–'34 (English), May 19, 1950.

Allan Chester Johnson, PH.D. '09 (Greek), March 2, 1955.

Sister Katharine Frances Judge, G. '34–'36 (Education), July 14, 1954.

Evelyn Raiford (Mrs. William D.) Keck, Graduate Nurse '42, January 17, 1955.

George August Leonard Kolmer, M.D. '13, November 21, 1954.

Paul Hartsock Leach, M.P.H. '47 September 28, 1954.

Norman C. Lindau, B.A. '15, January 27, 1955.

Leonard Noel Linsley, DR. ENG. '22 (Mechanical), October 27, 1954.

John Arthur Luetscher, M.D. '99, FAC. '05–'18 (Medicine), February 4, 1955.

Charles Markell, B.A. '02, February 24, 1955.

John Horace Masopust, B.A. '37, February 13, 1955.

Sister Genevieve McDermott, G. '27–'29, '30–'32 (Education), January 28, 1954.

Robert Clyde McKee, G. '10–'12 (Political Science), February 12, 1955.

James Samuel Mitchener, M.D. '15, March 18, 1953.

Irene Martha Blanchard (Mrs. Ambrose) Mueller, M.D. '17, November 16, 1954.

William Nelson Myers, B.E. '33, February 2, 1955.

Milton Newman, '33–'34 (Business Economics), March 12, 1949.

Helen Stack Rogers Owen, Graduate Nurse '35, September 28, 1954.

Glenn Worthington Owens, B.S. '19, G. '20–'21 (Education), December 24, 1954.

Oscar Lee Owens, PH.D. '16 (Political Science), October 25, 1954.

John Marshall Pels, '47–'48 (Arts), B.S. '52, December 27, 1954.

Albert Kofi Prempeh, G. '54 (SAIS), December 29, 1954.

Osborne Robinson Quayle, PH.D. '24 (Chemistry), December 6, 1954.

Suppiah Rasanayagam, M.P.H. '31, April 22, 1954.

Thomas Hinckley Robbins, '08–'09 (Medicine), November 14, 1954.

Francis Frederic Schwentker, professor of pediatrics and director of the department of pediatrics, November 8, 1954.

James Winn Sherrill, M.D. '17, January 4, 1955.

Nathan Horwitz Shpritz, B.A. '19, M.D. '24, February 13, 1955.

Arthur Whitmore Smith, PH.D. '03 (Physics), December 1, 1954.

Audley L. Smith, PH.D. '38 (English), September 10, 1954.

Patricia Sproule (Mrs. Washington C.) Huyler, Graduate Nurse '20, May 25, 1953.

Elizabeth Griffin (Mrs. William N.) Taul, Graduate Nurse '03, February 9, 1955.

Martin Buel Tinker, House Staff '00–'03 (Surgery), February 26, 1954.

David Ellsworth Tydings, '25–'29 (Arts), B.A. '31, G. '30–'31 (English), January 3, 1955.

Charles Alexander Van Arsdall, M.D. '49, July 21, 1954.

Clinton Carroll Waters, '17–'22 (Arts), December 19, 1954.

Horace Winfield Webster, B.A. '07, February 11, 1955.

George Alphonsus Weschler, G. '15–'16 (Mechanical Engineering), December 27, 1954.

Wallace Durant White, P.A.E. '94 (B.E. conferred '27), November 17, 1954.

Otis Buckminster Wight, M.D. '02, House Staff '02–'03 (Medicine), February 24, 1955.

Russell Bigelow Williams, M.D. '37, October 24, 1954.

Minnie Ada Wolfinger, '37–'38 (McCoy) January 2, 1955.

William Albert Earl Wright, G. '31–'33 (Education), November 25, 1954.

Janney McLean Yates, G. '24–'25 (Physics), April 14, 1949.

Richard Hart Young, FAC. and House Staff '32–'33 (Psychiatry), August 10, 1953.

Scientific Research: Some Implications

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of all branches of science and engineering, and we should be guilty of crass intellectual snobbery if we discounted any one of them. The meticulous worker who spends years establishing the real facts in a complex phenomenon or in perfecting a technique, or the routine-industrious man who explores an area thoroughly by a long series of measurements, provides means and materials for the creative artist and inductive thinker, materials they might not be able to get for themselves. The critical mind keeps thought and observations on the track, saving costly detours along false trails. Each has his place, and the secret of the efficient use of manpower either on a laboratory scale or on a nation-wide basis lies in assigning to each mind a job suited to its attributes and carrying with it the recognition of contributions to a worthwhile objective.

Throughout the centuries, the progress of science has depended on this teamwork. Although each investigator planned and carried out his work in a very private manner, he took care to make his results public as soon as possible, either through private communication to colleagues in various parts of the world or through articles in journals. As a result, the work of any investigator became available to others for criticism and extension; in short, all attributes of mind could be brought to bear on a scientific topic once it had been formulated and exposed by an investigator. An unorganized, but none the less effective, team made up of men from all nations quarried and polished the stones of which the structure of science is built.

Some of you may be disappointed that I have not included that well-oiled, relentlessly efficient thinking machine, "the scientific mind", in the foregoing catalogue. The omission is deliberate, since the contribution of this fictional thinking-apparatus to the progress of science has been negligible. It will be noted that the kinds of mind I have listed as contributing to science are essentially those to be found in any other occupation or profession.

It might be interesting to consider the resemblances and differences of scientific research and the creative arts—painting, poetry, music, etc. It has been the fashion to regard art and science as entirely separate and even antagonistic activities. But a very significant change is in progress. The kinship between the creative artist and the scientist is being rediscovered and reaffirmed; and scientists, it seems, are taking the initiative in this movement. The quotation I made from Hinshelwood is an example. I should like to quote two other passages expressing the same thought:

"We have a paradox in the method of science. The research man may often think and work like an artist, but he has to talk like a bookkeeper in terms of facts, figures and logical sequence of thought." (H. D. Smyth, quoted by Gerald Nolton in *American Scientist.*)

"The great scientist must be regarded as a creative artist and it is quite false to think of the scientist as a man who merely follows rules of logic and experiment." (W. I. B. Beveridge, "The Art of Scientific Investigation.")

It has been realized for a long time that the choice of a fruitful research problem, the selection of a fertile hypothesis, and the genesis of a brilliant theory are decisions whose quality differentiates the greater scientist from the lesser. They are decisions for which no rules of logic exist, but in which the imagination and the intuition of the investigator play the dominant part. In this sense the great scientist is also an artist, and also his imposing of a pattern on nature is definitely an artistic creation.

Indeed, the technique of the artist plays a much larger role in the development of science than is sometimes thought. Hunches, intuition, educated guesses have often been the bases for critical and illuminating experiments or the start of fruitful theories. However, after the author has arrived at the result by hunch or intuition he has taken pains to develop a rigorous justification of it in terms of conventional logic and consistent theory. In more than one case, the scientist has covered up the tracks of the artist.

However, we may go further in establishing an affinity between art and science along lines that were laid down by Martin Johnson a few years ago in an interesting book entitled "Art and Scientific Thought—Historical Studies Toward a Modern Revision of Their Antagonism." The creative artist is one whose imagination gives him a penetrating insight into the significance of some human experience, and whose craftsmanship enables him to build this insight into a pattern or structure by which it is communicated to sophisticated observers. In a disciplined art, imagination weaves ideas into a pattern

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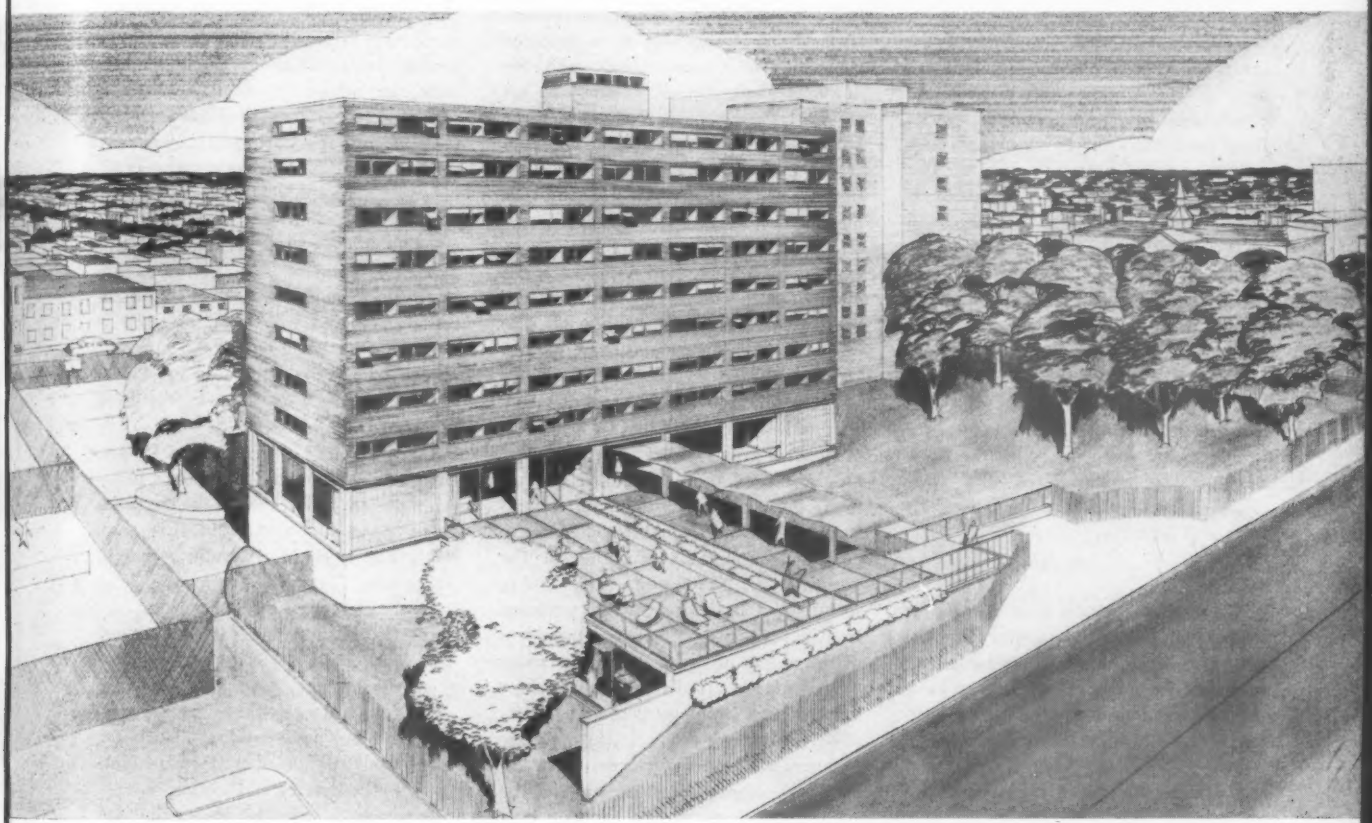
NEW DORMITORY



Johns Hopkins plans a much-needed medical-student residence

Since the days of "Miss Susie Slagle's," students at the Johns Hopkins Medical Institutions have been living in private homes in the once-elegant neighborhood. But the section has deteriorated steadily over the past few decades, and housing has become increasingly hard to find.

Several years ago twelve square blocks west of the Hospital were declared slum areas by the City of Baltimore. Subsequently the dilapidated structures were razed and a development program was initiated. Demolition of the houses along Broadway, where many students lived, made the housing shortage acute.

The Hopkins institutions plan to purchase some of the land in the redevelopment area. On it they visualize a modern, eight-story, $1.6 million student dormitory. The building, with a capacity of 255 occupants, will provide adequate housing for many years to come.

Facilities will include an air-conditioned cafeteria equipped to serve 250 people at once; a separate floor for thirty women; tennis courts; a basketball and badminton court; and a sun deck. The dorm, "the most needed single improvement" to the medical plant, will be financed by a low-interest federal loan and should be ready for occupancy by the autumn of 1956.

Scientific Research: Some Implications

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that awakens the observer to a transcending realization of some truth or experience. The actual ideas conjured up in the mind of one observer may, however, differ in detail from those of the artist or those of some other observer, depending on their past experiences.

Compare this with the work of the creative scientist whose imagination sees the significant facts in certain phenomena and leads him to weave these facts into a satisfying pattern that he can communicate to others. The resemblance is obvious; the difference is also obvious. The patterns (theories) of the scientist must be communicable to his audience in such a way that formal deductions and interpretations made by each individual agree exactly with those of any other individual and with those of the author. This quantitative communicability of patterns of fact is the characteristic that differentiates science from art and, even more, as we have seen, is fundamental to the only criterion for the validity of the scientist's facts and patterns.

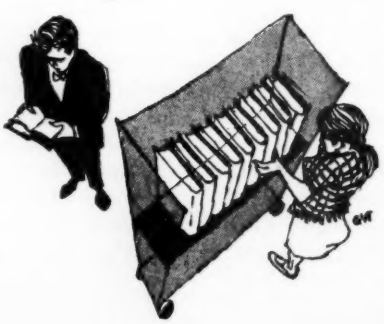
Aside from establishing a basis for interaction between two great human activities and thereby strengthening both, the foregoing considerations have implications of considerable interest in our attitude toward scientific research. They remind us that the physical sciences and indeed all the sciences are an integral part of human knowledge, experience, and expression, and not the specialized preoccupation of a few odd characters. They remind us that industry, imagination, and a well stocked mind are as important and effective in scientific research as the other intellectual or aesthetic occupations. They also remind us that quantitative communicability of facts and patterns is a fundamental, if not *the* fundamental, characteristic of science.

Imagination enters into the ordering of the facts into satisfying patterns or theories, and in the perception of the implications of the patterns, but not into interpretation of the communications the listener receives from the author. However, not only must the scientist have the power of exact expression, but the pattern he wishes to communicate must also be *capable* of exact and unambiguous expression and interpretation.

This requirement for exact and quantitative communicability in scientific research has placed severe limitations on the subjects available up to now for scientific study. These subjects must be so simple that all the significant variables can be isolated, expressed quantitatively, and related by some logic such as mathematics. However, as the patterns of science are extended, their ability to include more complex subjects grows exponentially and the limits of their application are still far away. Indeed, if we follow Herbert Dingle and use the term "valid human experience" rather than "facts" we see that the application of scientific research may extend beyond the physical world of August Comte and the Victorians. In the meantime, however, there are areas of such complexity and haziness that they are currently beyond the reach of exact science and must, as yet, be left to the artist.

The requirement for quantitative communicability has led to a steady monotonic progress of science from one generation to another, knowledge fulfilling this requirement being immune to the vagaries of fashion which cause periodic fluctuations of value in the creations of the artist. The young scientist of today sees the universe from a vantage point on the shoulders of the giants of the past, the inheritor of a cumulative tradition which enables him to attack problems that were impossible only yesterday. The steady progress of science, contrasted with the cycles of opinion in the arts, is the reward the scientist receives for confining his attention to simple subjects and avoiding the siren call of the colorful wildernesses of human experience.

The steady progress of science over the last three hundred years, contrasted with the changing natural philosophies of the previous millennia, leads us to speculate about natural selection in the survival of systems of knowledge. Was it a happy accident that Galileo, Newton, and others stumbled on a pattern that has been capable of continuous extension, that accommodates such a range of valid experiences, and that had the property of quantitative communicability?



In the foregoing discussion, I have made very little mention of the subjects studied by scientific research. I have done so advisedly, first because I wished to discuss methods and objectives which apply to any science at some stage in its development, second because the subjects susceptible to scientific research are continually increasing and may be expected to do so. From one point of view, however, this is a serious omission because the interest of men and women in research is more frequently derived from curiosity about a given subject or youthful fascination by an art, than from interest in the abstract methods.

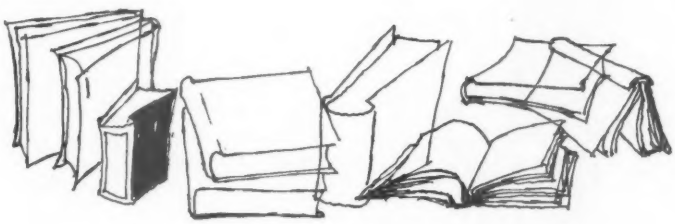
In an attempt to isolate the "something" that differentiates modern natural philosophy from that of the ancients, we have noted four activities which play important roles in scientific research. These are:

(1) Exploration and description;
(2) Establishment of facts by experiment and the criterion of reproducibility;
(3) Communication in exact quantitative terms; and
(4) Construction of patterns of facts —the making of theories.

A moment's reflection shows that not one of these activities by itself may be considered as belonging uniquely to scientific research. Exploration and description are an old and common activity of mankind pursued for pleasure, profit, or sheer restlessness, as well as for research. The experimental approach to the acquisition of knowledge is practiced by every healthy infant, and empirical methods of acquiring facts have for ages been the stock-in-trade of the practitioners of the useful arts, the farmers, the smiths, and the medical men. Reproducibility is an elementary adjunct in the learning process of humans and animals; the coincidence of the stories of several witnesses has long been a criterion of the validity of evidence in courts of

law. Thus even the high place given to reproducibility in modern research does not assure it of a place as a property unique to science. The construction of refined patterns expressing human thought and experience has been practiced by the creative artists from time immemorial and the patterns of thought in common sense, fragile though they may be, are a part of the mental equipment of every rational human being, the guide for his actions throughout life. Quantitative communication of ideas and facts has long been found to be an essential practice by the merchant, the banker, the artisan and the engineer.

The "something" that differentiates scientific research is to be found not in isolated methods or activities but in the system as a whole. It is in the balanced interplay of these four activities in an



integrated system that the "something" unique to modern scientific research is to be found. This, together with the growing belief in the unity of nature and in the ultimate possibility of a universal, consistent pattern that embraces all the valid facts of human experience, constitutes the core and the goal of scientific research.

In his oration introducing the late Sir John Lennard-Jones for an honorary degree at Oxford, the Public Orator concluded, "Science is split into departments only to prove its unity in the end." This thought has always been in the minds of natural philosophers even when appearances were much against it.

The more facts we learn and the more penetrating our understanding becomes, the more does the evidence against the concept of the unity of nature disappear. In fact, the feeling that all nature cannot be comprehended by a single pattern of thought seems to be associated with the earlier and exploratory stages of any particular science.

For example, at the beginning of this century, chemical forces, the forces holding atoms together in molecules, were well known from a phenomenological point of view, but all evidence tended to show that they were quite different from the forces which the physicist studied and handled. The advent of quantum mechanics showed the identity of chemical and physical forces (to use a vague expression) and nowadays it is almost taken for granted that, basically, the phenomena of physics and those of chemistry may be described by the same set of fundamental terms. So also twenty years ago there were many who held that a "vital principle or force" gave rise to a fundamental distinction between the phenomena of biology and those of chemistry and physics. Today, I think that far-sighted biologists believe that an extension of the theories of physics and chemistry will ultimately embrace the facts and generalizations of the various biological sciences.

These examples are chosen from many that could illustrate the same point. They in no way constitute an argument, but I feel intuitively that a belief in the unity of nature is at least too good a working hypothesis to give up until we are forced to do so. If this hypothesis holds up, we can expect that in the distant future we shall be able to construct a consistent and satisfying pattern which is communicable in a quantitative way and which comprehends all valid facts of human experience.

It is possible, of course, that the experience of the past might be completely wiped out and some future generation might have to start its development over again, thus postponing the day of a universal theory. It is even possible, but less likely, that the human race might so change in its intellectual aspirations that the oscillations in the circuits of our diagram die out altogether. The possibility of temporary attenuation of the current in these circuits by social, political, or ideological upheavals is not to be completely dis-

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★

Address inquiries to the membership chairman, Henry D. West

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Scientific Research: Some Implications

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counted, but stoppages of this sort will only have a negligible effect for one good reason. As long as man is what he is, the circuits hold the ingredients for a renewed build-up, and scientific research will again become an essential for survival in a crowded world.

In the foregoing analysis, I have stressed, but I hope not to the point of distortion, the kinship of scientific research with other intellectual activities. Although I have tried to introduce into the analysis ideas that apply to all fields of science, I must warn you that I am a physical chemist. This background cannot fail to influence my discussion, much as I would consciously avoid it. I have pointed out that the types of mind engaged in, and the functions exercised in the pursuit of, scientific research are in general the same as those found in any other fields of human activity, and that the only characteristic we can call peculiar to modern scientific research lies in its demand for disciplined exercise of a complete interlocking system of experiment, theory, and communication. I have suggested that scientific research has within itself the capacity to forge tools to break down the limitations that today restrict its horizons to simpler subjects and that we may regard its extension into more complicated, but perhaps more intimate, fields of human experience as merely a matter of time. I have also suggested that the hope of an integrated pattern capable of embracing all valid experience is not forbidden by any compelling evidence now before us. However, despite this common human background and this catholicity of scope, scientific research has made little, if any, impression on the habits of thought in society at large.

We are daily receiving fresh proof that the popularization of scientific doctrines is producing as great an alteration in the mental state of society as the material applications are affecting its outward life. Such indeed is the respect paid to science, that the most absurd opinions may become current, provided they are expressed in language the sound of which recalls some well known scientific phrase. If society is thus prepared to receive all kinds of scientific doctrine, it is our part to provide for the diffusion and cultivation not only of true scientific principles but of a spirit of sound criticism founded on an examination of the evidence on which statements apparently scientific depend."

These remarks were made by James Clark Maxwell at the opening of the Cavendish Laboratory in 1871; the situation has not changed much. I think it can be said without risk of overstatement that the *mores* of our

generation are not influenced by the discipline of scientific research and the implications and the spirit of this discipline have not penetrated into a large enough segment of public opinion to have much influence in the processes of democracy. The problem is a large one and urgent reasons for seeking a solution are uppermost in the minds of all of us. I shall not presume to propose any kind of general solutions here. "Mental vegetation and the spontaneous myth" still have a strong appeal.

As members of a university, we have little grounds for complacency. As the years have rolled by since the opening of Cavendish Laboratory, larger and larger numbers of the population have come under our influence. The proportion of college and university graduates among our people has increased. But the effect of all this in disseminating more widely a "spirit of sound criticism founded on examination of the evidence" has been microscopic.

I should, therefore, like to make a few observations on the implications of scientific research in education. The prime function of the universities and colleges is to prepare youth for intellectual leadership in meeting the problems of their day and generation. The first I shall arbitrarily call "general education," the second "training for a profession." By "general education," I mean a process whose objective is to bring out certain qualities of mind, to exercise and to grow those faculties and judgments employed in disciplined intellectual activity. By "training for a profession" I mean the acquisition of specialized knowledge and facility with the techniques and methods characteristic of a given field of endeavor and its applications.

It is clear that preparation for leadership requires that "training for a profession" be preceded by "general education," but the exigencies of specialized training have tended to crowd this necessary preliminary out of university programs. And it certainly is not being supplied by the high schools. The effect is felt in many ways, not the least being in the quality of our scientific research, and many thoughtful people are seeking ways to revise the scope of college curricula in order to provide a more liberal education.

There is a tendency to patch up evident discrepancies in current education by reviving courses in humanities. A number of colleges pride themselves on introducing students of science to a smattering of these subjects. Diligently and deeply pursued, the humanities have proved to be excellent foundations for education. But I wonder if they have an exclusive claim in the field. The qualities of mind to be cultivated, the faculties to be exercised in a general education may be summarized as follows:

(1) The capacity for clear and fluent communication with other people, with the outside world, and with oneself. Powers of observation, description, writing, speech, manners.

(2) The capacity for and acquisition of knowledge and experience—building up a well stocked mental inventory.

(3) Habits of discipline and continual critical analysis to distinguish valid

from trivial experience. Standards of values.

(4) Power of building consistent mental patterns of knowledge—the basis of understanding and judgment.

(5) Cultivation of imagination; the association of ideas and the power of building hypothetical mental patterns, predicting their consequences; the courage to pursue their progress to new experiences.

With such equipment, a man can rise to leadership in any intellectual field of human endeavor.

The considerations I have advanced in this article show that the study of any one of the more advanced sciences and its methods can provide material for growing and exercising this mental equipment, and I suggest very strongly that this potentiality be exploited in the education of undergraduates. It could be a very important component of the general education of all undergraduates, including those who do not intend to follow careers in science or engineering as well as those who do. For the latter, it could provide mental training and discipline and the acquisition of subject matter at the same time.

In our graduate schools, the pressure for a streamlined "training for a profession" is even greater. The amount of background knowledge a scientist or engineer must have increases daily. The demand for trained research workers has grown by orders of magnitude. But the emphasis is on numbers rather than quality. This is not a climate that is conducive to training intellectual leaders in scientific research, and many of our graduate schools have succumbed to the effect of this climate.

What we need are more men and women whose education fits them to operate imaginatively the system we have described—the system in which are linked together in regenerative circuits: exploration inspired by curiosity; observation and description; the mining of facts by experiment; the refining of the gold in them from the dross of irrelevancy and error; the assaying of the gold by the touchstone of reproducibility; the weaving of the gold into consistent patterns and the displaying of this tapestry before the world in clear-cut, simple, and direct communications.

What we are training, all too frequently, are men and women whose minds are well stocked with specialized knowledge, "who know," as G. B. Kistiakowsky put it, "how to carry out instructions and follow in the footsteps of others but who have not learned how to discover a rewarding research problem, how to plan an attack on it, and how to solve it."

MANY a graduate student leaves a university with a degree of doctor of philosophy, the outward sign of mastery in scientific research, with only the most meager acquaintance with these principles and practically no exercise in their application. In a crowded schedule with little time for reflection, he has taken a large number of specialized classroom courses. He has worked on a problem *given* him by a professor, in which he has constructed a piece of apparatus and made a few measurements to prove a particular theory or in which he may have served his time in the data factory associated with some large and expensive instrument. The results, hurriedly incorporated into a thesis, are seldom put into communicable form by the student. At some later date, the professor will write them up for publication to the world of science with the student's name as junior author.

I admit this is an exaggeration, but it is approximated all too frequently. And, as I have said, the prevailing climate promotes rather than discourages this state of affairs. In other words, there is a tendency for the degree of PH.D. to denote mastery of a craft rather than leadership in an intellectual profession.

Having in mind the universal problem of inflation, I hardly think it realistic to suggest that we raise the master's degree to the present level of the PH.D. and elevate the requirements for the latter. Perhaps we should consider another degree, one earned on a more leisurely time scale, one requiring imaginative approaches to original problems selected and carried out by the candidate, one requiring the completion of a substantial piece of work in which the discovery and establishment of facts, the construction of a satisfying theory, and the communication of the results to the world are integrated.

THERE is another implication of scientific research which merits a few remarks as I close. The imposition of a pattern on nature is an artistic creation by men. But it is governed by a very severe and rigid discipline, a discipline which does not derive its authority from any one man, school, or group of men. Human authority has no part to play in the establishment of facts or in judging the validity of patterns of facts. Indeed, the discipline of scientific research is based on a foundation so broad that it may be considered as imposed on man by an authority external to himself.

It is therefore with dismay that we see scientists set up as authorities, either by themselves or by others, when the whole aim of scientific research is to find and obey an authority external to man. Three hundred years ago, students of nature threw over the authority of Plato and Aristotle and made progress which has continued steadily ever since. Let us never return to it, even if it comes disguised in the form of a "committee of top-flight scientists."

By applying the system of scientific research in sincere humility, mankind can, as generation succeeds generation, gradually weave from facts the pattern of creation—the pattern which transcends even the substance that reveals it to him, the pattern which reflects the authority from which it derives.

The eternal stability of the pattern, the Logos, the Word, has ever been the theme of the saint, the seer, the prophet, and all who have sought to penetrate through the ephemeral to the everlasting. Its appeal to man in search of the permanent, the aesthetic, and the satisfying is summed up by St. John, the Divine:

In the beginning was the Word. . . . The same was in the beginning with God. . . . All things were made by Him and without Him was not anything made that was made. In Him was life, and the life was in the light of man.

Events At Johns Hopkins

TELEVISION

TOMORROW—A new television program, presented by the Johns Hopkins University and the American Broadcasting Company, made its bow last month. Moderated by Lynn Poole, it is a successor to "The Johns Hopkins Science Review," which after becoming the third longest-run program on television has been replaced. "Tomorrow" appears on ABC stations from coast to coast, originating in the studios of Station WAAM in Baltimore on Saturday nights at 7 o'clock, Eastern time. The full list of stations was not available when this Calendar of Events went to press; but readers may check their local ABC stations or newspaper listings for the schedule in their cities.

ALUMNI MEETINGS

CHEMISTRY ALUMNI—Two Hopkins Hours will be held for chemistry alumni attending the meetings of the American Chemical Society in Cincinnati (Thursday, March 31 at 5 p.m. and Tuesday, April 5 at 5 p.m.; both meetings will be held at the University Club, Cincinnati).

LACROSSE ALUMNI—An informal get-together of lacrosse alumni will follow the Harvard-Hopkins game (Wednesday, April 6 at 8 p.m. in the ROTC Auditorium).

NEW YORK—A Johns Hopkins Glee Club Concert sponsored by the Alumni Association of New York, New Jersey, and Connecticut and the Johns Hopkins Club of New York (Friday, April 15 at 8:30 p.m. at the Park Sheraton Hotel).

VARSITY SPORTS

NOTE—No admission fee is charged at Johns Hopkins home athletic events, but an admission card is required. Persons who wish to attend Hopkins games during the current University year may obtain a card without charge by sending a stamped, self-addressed envelope to the Department of Physical Education, the Johns Hopkins University, Baltimore 18, Md. Alumni of the University should address their requests for admission cards to the Alumni Relations Office, Shriver Hall, the Johns Hopkins University, Baltimore 18, Md.

LACROSSE—Johns Hopkins vs. HARVARD on Wednesday, April 6 (Homewood Field at 4 p.m.); YALE on Saturday, April 9 (Homewood Field at 2:30 p.m.); RUTGERS on Saturday, April 16 (away); PRINCETON on Saturday, April 23 (Homewood Field at 2:30 p.m.); VIRGINIA on Saturday, April 30 (away); LOYOLA on Wednesday, May 4 (Homewood Field at 4 p.m.); R.P.I. on Saturday, May 7 (away).

BASEBALL—Johns Hopkins vs. M.I.T. on Thursday, March 31 (Homewood at 3 p.m.); AMERICAN on Wednesday, April 13 (Homewood at 3 p.m.); URSINUS on Saturday, April 16 (away); TOWSON TEACHERS on Thursday, April 21 (away); DELAWARE on Saturday, April 23 (away); GETTYSBURG on Thursday, April 28 (Homewood at 3 p.m.); SWARTHMORE on Saturday, April 30 (Homewood at 12 noon); CATHOLIC on Tuesday, May 3 (Homewood at 3 p.m.); WESTERN MARYLAND on Thursday, May 5 (away); WASHINGTON COLLEGE on Saturday, May 7 (away).

GOLF—Johns Hopkins vs. DARTMOUTH on Thursday, April 7 (Mount Pleasant Golf Course at 1:30 p.m.); WESTERN MARYLAND on Wednesday, April 20 (Mount Pleasant Golf Course at 1:30 p.m.); FRANKLIN AND MARSHALL on Tuesday, April 26 (away); DELAWARE on Thursday, April 28 (Mount Pleasant Golf Course at 1:30 p.m.); GETTYSBURG on Tuesday, May 3 (Mount Pleasant Golf Course at 1:30 p.m.); MARYLAND on Friday, May 6 (away).

TENNIS—Johns Hopkins vs. AMERICAN on Wednesday, April 13 (Homewood at 3 p.m.); TOWSON TEACHERS on Saturday, April 16 (Homewood at 2 p.m.); GETTYSBURG on Wednesday, April 20 (away); DELAWARE on Saturday, April 23 (away); TOWSON TEACHERS on Wednesday, April 27 (Homewood at 3 p.m.); WESTERN MARYLAND on Saturday, April 30 (Homewood at 2 p.m.); LOYOLA on Thursday, May 5 (Homewood at 3 p.m.); WASHINGTON on Saturday, May 7 (away).

TRACK—Johns Hopkins vs. SWARTHMORE on Saturday, April 16 (Homewood at 2 p.m.); GETTYSBURG on Wednesday, April 20 (away); CATHOLIC on Saturday, April 23 (away); PENN RELAYS on Saturday, April 30 (away); DELAWARE on Tuesday, May 3 (away); LOYOLA on Saturday, May 7 (Homewood at 2 p.m.).

LECTURES

POETRY READINGS—Edith Sitwell will read her poetry in a presentation open to the public without charge (Wednesday, March 30 at 3:45 p.m. in Shriver Hall).

DEICHES LECTURE—Abraham Kaplan, professor of philosophy at U.C.L.A., will speak on "What Does Art Express?" in the annual lecture, open to the public without charge (Wednesday, March 30 at 5 p.m. in Shriver Hall).

UNIVERSITY LECTURE—Alexander G. Christie, emeritus professor of mechanical engineering, will speak on "Engineering in Modern Life" in a lecture that is open to the public without charge (Wednesday, April 13 at 4:15 p.m. in Shriver Hall).

JOHN HINKLEY LECTURES IN ENGLISH HISTORY—A series of three lectures entitled "Queen Elizabeth I and Limited Monarchy" will be given by William H. Dunham, George Burton Adams professor of history at Yale. MONDAY, APRIL 18—"King Henry VIII—England's Independence"; TUESDAY, APRIL 19—"Queen Mary I—Authority of Parliament"; WEDNESDAY, APRIL 20—"Queen Elizabeth I, Sovereign and Crown" (all lectures at 4:15 p.m. in room 111, Mergenthaler Hall).

THAYER MEMORIAL LECTURES—William B. Castle, professor of medicine at the Harvard University School of Medicine, will speak on "Pernicious Anaemia: An Exquisitely Conditioned Nutritional Deficiency" (Tuesday, April 19 at 5 p.m. in Hurd Hall). Dr. Castle will speak on "Red Cell Destruction: Immediate Mechanism in Certain Hemolytic Anaemias" (Wednesday, April 20 at 5 p.m. in Hurd Hall).

DE LAMAR LECTURE—Thomas Francis, Jr., professor of epidemiology at the University of Michigan, will speak on "Active Immunization Against Poliomyelitis" (Wednesday, April 27 at 5 p.m. in the School of Hygiene Auditorium).

MISCELLANY

JOHNS HOPKINS MEDICAL SOCIETY—Monday, April 11 at 8 p.m. (Hurd Hall).

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—The Johns Hopkins University will be the scene of the annual conference of the student branches of Region III of the ASME (Friday and Saturday. April 29 and 30).

GLEE CLUB—The annual home concert will be held in Shriver Hall on Saturday, April 30. The club will also present a concert on the evening of Saturday, April 2 at the Hotel Dennis, Atlantic City.

DAVID SEYMOUR, MAGNUM

NEXT MONTH

The University of Bologna, in Italy, is the oldest university in the world. The precise date of its founding is shrouded in mists of history. But its motto, *Alma Mater Studiorum*, is acknowledged throughout the western world as truly descriptive of its place in the development of higher learning. Next month, in a special issue of pictures by David Seymour and text by the editor, The Johns Hopkins Magazine presents a report on the University of Bologna today; on its traditions, its people, its vitality. Look for the twenty-eight-page essay in the May issue of

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A red-nosed Fokker slowly spun to earth

AT 4:35 P.M., on October 30, 1918, a lone Spad biplane, marked with the symbol of the "Hat-in-the-Ring" Squadron, hawked down through the quiet skies over Grande Pré. Seconds later, a twenty-round burst of its guns smashed full into the center of a low-flying Fokker and sent the German plane swirling earthward like an autumn leaf.

The C.O. of the squadron, Captain Eddie Rickenbacker, had downed his last enemy plane of the war, setting a record for aerial combat never equaled: 26 victories in 7 months. It made him the American ace of aces.

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